FLIGHT
and The AIRCRAFT ENGINEER

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The Outlook

Not So Bad After All

ONE of the questions which have occupied the minds of many during the last few years has been concerned with the effect on the young pilot of all the controls and "gadgetry" with which the modern military aeroplane bristles. There were those who feared that too much was being asked of the pilot; that he had too many things to remember, the omission of any one of which might lead to disaster.

We hope that those who held that view have been reading "Indicator's" impressions of his experiences. They will have discovered that at least one pilot, previously accustomed mainly to aircraft of the light and very light class, has not found the transition period unduly nerve-racking.

The whole secret seems to lie in the fact that the procedure has been carefully systematised. By doing things in a particular sequence, the number of tasks that have to be performed becomes less terrifying, and in time they are done without conscious thought.

In his notes in this week's issue "Indicator" calls attention, in his usual whimsical way, to the possibility that "when it is all over" he will probably take off a Tiger Moth with the petrol tap shut and the trimming lever in the landing position. That, we presume, will be after having made fruitless grabs at missing levers and stabs at buttons that are not there!

There is, however, another aspect of this complication of the modern aeroplane which still gives rise to anxiety. By systematic training the pilot may not find the purely mechanical part of his task too difficult. But the fact remains that the miles of pipe lines, the dozens of instrument dials, the half-dozens of controls, form a source of vulnerability and of mechanical defect which may prove serious. There is not yet sufficient field experience to answer one's doubts and misgivings. The modern aeroplane is a box of tricks, and even the best of mechanisms will go wrong at times.

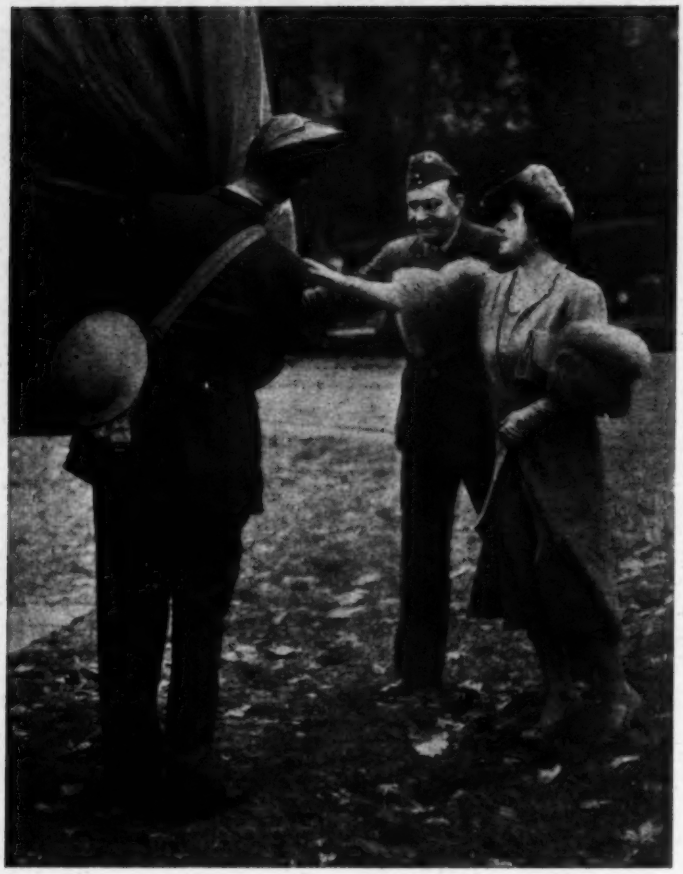
Bombers versus Fighters

WHATEVER one writes in these days may be falsified by later happenings before the words appear in print, but up to the present the tactics of the German bombers which have approached these shores have been unimpressive, and the results must be very discouraging to their side. One of the questions which used to be debated in the good old days of peace was the chances of a bomber squadron in formation against the attack of a fighter squadron. The bomber case was that the cross-fire of the rear gunners would hold the fighters at bay. This was one of the many questions which it was said that only war could settle, and perhaps some whose interest in air tactics outran their love of peace looked forward to a war to settle it.

So far the Germans have provided no opportunity for determining the point. Their raids on our coasts have been made by flights of two or three machines, and in the attack on South Queensferry single bombers were seen flying over Edinburgh. When our fighters got on to their tails the Junkers pilots were always trying to escape. No case has been reported of a whole squadron in tight formation fighting, or trying to fight, its way in.

It may be that the Germans hold the theory that a formation of a dozen or so of machines makes too conspicuous a mark for the A.A. guns, and is not flexible enough to adopt evasive tactics by varying height and direction while the shells are coming up at them. They may also doubt whether even formation flying and cross-fire would save them from our deadly eight-gun fighters. Whatever the reason, their raids so far have been singularly ineffective—harmless to us, more or less disastrous to the raiders. In the popular phrase, they have had no luck; but good luck is usually on the side of good management.

It may remain for our men to show the powers of bombers in formation.



ROYAL INTEREST: Her Majesty the Queen accompanied the King recently on a tour of inspection of units of the Balloon Barrage Group. Here she is obviously intrigued by the texture of the balloon fabric. Beyond Her Majesty is Group Captain F. A. Baldwin.

Attacks on Moving Ships

THE same lack of success has attended the attempts of the German machines, sometimes bombers, sometimes flying boats, to plant a bomb on any of our ships at sea—or even on those in harbour. The damage done to the old *Iron Duke* was not worth the life of a single Pomeranian bomb-aimer, and the casualties among the crew of the destroyer *Mohawk* (though we mourn the loss of brave sailors) went no further towards crippling Britain's sea power. No moving ship has yet been damaged by an air bomb. The fire of the A.A. guns on our warships has evidently quite put the Germans off their aim, and has sometimes winged a raider. When our fighters have intervened, they have always made a bag.

Another old subject of argument was the degree of safety offered by the convoying of merchant ships. It was known to give protection against submarines, but it was supposed to offer a better target to attacks from the air. The first case of such an air attack on a convoy took place last Saturday, and was repeated twice by a force of a dozen machines. The guns of the escort brought down one, and fighters from the shore shot down three more. Twenty-five per cent. seems to be the usual proportion of German losses when they press home their attacks. That can hardly be inspiriting to the surviving German crews. Fighting men will face losses for a worthwhile success, but the Germans have not yet won a prize.

Choice of Targets

THE future student of air warfare will note as a point of especial interest that the first targets chosen for German air raiders have been British warships and convoys. Whatever may happen later, the German *Luftwaffe* has commenced the war by striking at our naval power. The attacks have not been made in great force; but then we did not send any very great force to raid Wilhelmshaven and Brunsbüttel. The point to note is that the enemy has shown better war-sense than many people were inclined to credit him with, by choosing strictly military targets at the outset. He has shown that he realises how surely naval power will win the war, even if it is not won otherwise, and that his only chance of escaping defeat (poor chance though it may be) is to cripple the British Navy. So far his U-boats have two capital ships to their credit, while the *Luftwaffe* cannot claim a success. At least it can be said for the Germans that their direction of air attacks has not begun with the sheer senseless brutality of bombing civil populations. We do not believe the present rulers of Germany incapable of such brutality, for their machine-gunning of helpless fugitives in Poland proved their war morality to be on the very lowest level, but we may respect manifestations of common sense in the choice of targets.

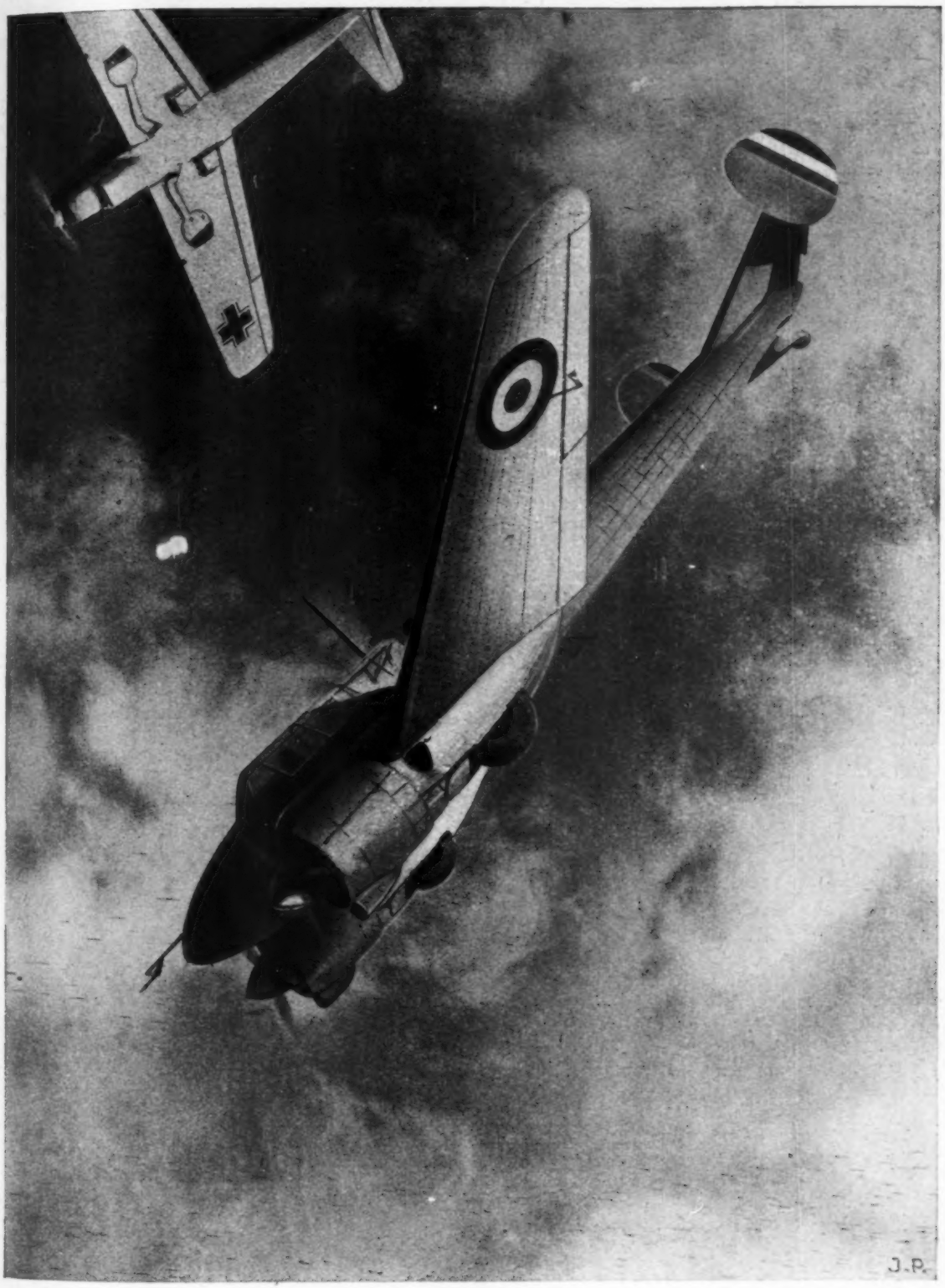
Commissions by Merit

ALL three fighting Services have now subscribed, in varying degrees, to the principle of choosing officers from the ranks or the lower deck during the war. The Navy is confining this principle to the pilots and observers of the Fleet Air Arm in so far as they are not ordinary naval or marine officers. The system is described in the Service pages of this issue. The Royal Air Force will give direct commissions as pilot or observer to none but the small number of men who hold the proficiency certificate of a university air squadron—and this only fulfills an undertaking made long before the war. All other would-be pilots and observers have to enter as sergeants of the R.A.F.V.R. and stay in that rank at least until they have passed out of the advanced training squadron at an F.T.S.

Whatever may be the best policy in time of peace, the system of commissions from the ranks in a time of war has been found to work well. In a war nothing matters except winning the war, and men ask nothing from their officers except that they should be good leaders and good organisers. It can certainly be said for the traditional officers of the Services that they had high ideals of their duty towards their men, and the war officers will be expected to maintain those ideals. Sometimes in the last war men who had gone straight from school to commissions in the R.F.C. showed less consideration for their men than officers transferred from the Army.

In the last war an officer who had been a sergeant in a crack regiment before receiving his commission was asked which position he preferred, and he replied, "Well, as a sergeant you were not able to sympathise with your men, and as an officer you can." We feel confident that the new officers will live up to that standard, and we hope that a more sympathetic type of sergeant has now arisen.

A MATCH for the MESSERSCHMITT



Agile and versatile, the French Potez 63 multi-purpose monoplane, with two 700 h.p. small-diameter Gnome Rhone 14M engines, is a formidable adversary for the single-seater Messerschmitt Me 109. The Potez 63 is in service in considerable numbers and can be used for fighting, light bombing, ground attack, and reconnaissance. As a fighter it carries two 20 mm. Hispano shell-guns under the nose and one or more machine guns.

WAR IN THE AIR

The Raid on the Forth

A READER of *Flight* who lives near Edinburgh sends us his impressions of the air raid on the Firth of Forth on October 16. "At about 2.30," he writes, "I heard an aeroplane flying at a great height. The noise of the engine was more guttural than that of British engines. Half an hour later two twin-engined bombers came up from the west, flying at a fair rate of knots. I was able, thanks to the illustrations in last week's issue of *Flight*, to identify them as Junkers 88s. Again the deep, rough note of the engines was most noticeable. The round cowlings over the engines, which, incidentally, are mounted very far forward, the crosses on the wings, and the single large fin, were all impressed upon my mind in that first and certainly memorable view.

"Suddenly I heard a high-pitched whine, and a British fighter was coming up smoothly, with 100 m.p.h. to spare on the Junkers. It was slightly higher, and while still some way off the Germans it dived and came on with incredible speed. The machine guns emitted a continuous chatter, and the fighter banked and flew off to the north. Its place was taken shortly afterwards by another fighter which dived at the Germans. Both disappeared in a low cloud.

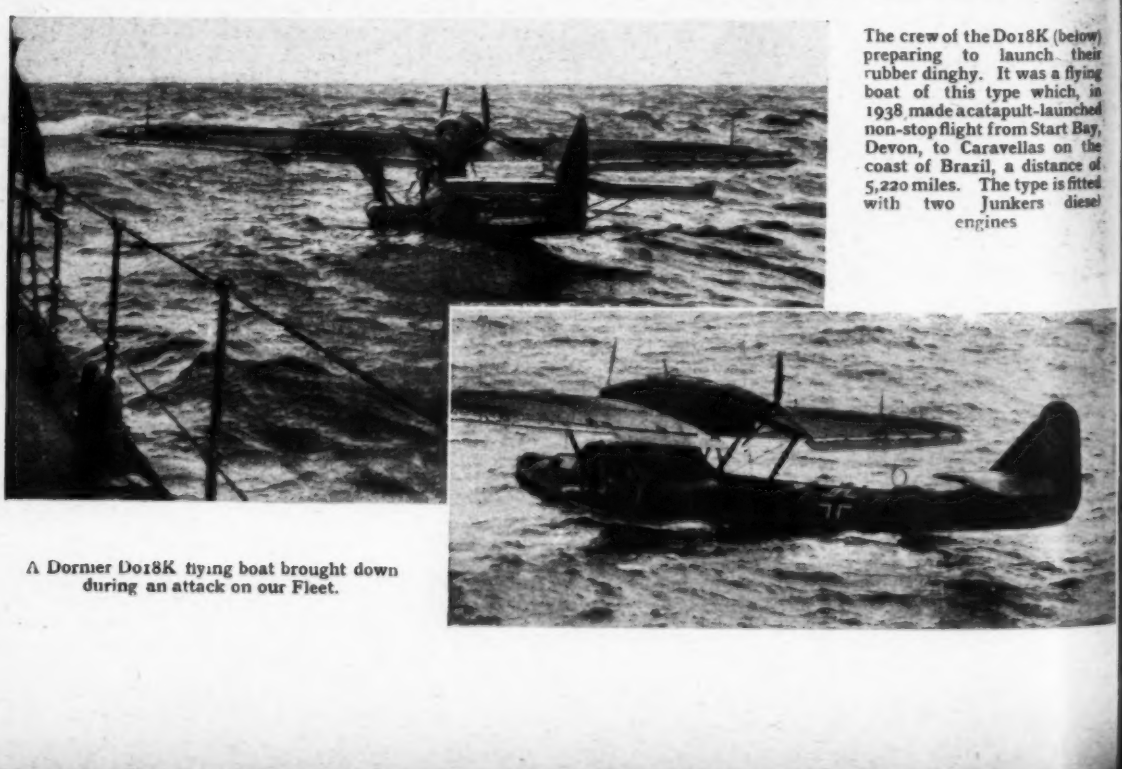
"The most favourable impression the incident gave me was the obvious superiority in speed which our fighters had over the Junkers. Theoretically it is only 40-50 m.p.h., but actually it seemed well over 100 m.p.h."

It was revealed by the Prime Minister that the honour of shooting down the first German raiders which crossed our coast, namely, in the attack on the Fleet in the Firth of Forth, belonged to the Auxiliary Air Force. *Flight* has visited the Edinburgh squadron and various other squadrons of the A.A.F., and has described how much impressed our representatives were by the keenness and efficiency of those squadrons. Since the date of those visits some squadrons have been converted from bombers into fighters—a move which showed inspiration on the part of the authorities. In the first place, it was obvious that the pilots were good enough to handle high-speed machines and to handle them well. Added to this, men who fight for the actual protection of their own home town would naturally fight with a special concentrated fury which bodes ill for the raiders. In this case all eye-witnesses agree as to the skill and determination with which the fighters of the A.A.F. attacked the German bombers. Admittedly they shot down three of them and it is not known for certain how many more of the raiders were hard hit by the guns of the fighters when out of sight. *Flight* offers its congratulations to the pilots of these gallant squadrons, some of whom have probably in the past played the part of hosts to our representatives. We also congratulate the anti-aircraft gunners on having brought down at least one of the raiders. The A.A.F. is now said to have "lost its amateur status."

Another correspondent, writing from Edinburgh, describes a German bullet which was picked up after the raid as "apparently an 0.450." Whatever the precise calibre (possibly 0.5in.) it seems certain that the latest types of German bomber are being armed with something considerably more powerful than the standard 7.9 mm. (0.311in.) gun. In this connection it may be recalled that there is a 0.5in. Browning model which fires explosive bullets at the rate of 1,000 a minute. The bullet weighs, according to type, 42-51 gr., and has an initial velocity of 2,625-2,950 ft./sec.

To Warn or Not to Warn

IT was mentioned in these columns last week that no air-raid warning was sounded before the Germans approached Edinburgh and the Firth of Forth, and this caused great surprise, not amounting to dismay. Still, the question was asked, "Had our means of communication broken down? Was it possible that the Observer Corps, which had always performed with so much credit during the Air Exercises year after year, had, after six weeks of scanning the empty skies until their eyes ached in the vain search for raiders which did not come, at last relaxed their vigilance?" It is very satisfactory to learn that there was no breakdown in our system of information and reports. On the contrary, the authorities of the Fighter Command of the Royal Air Force had full infor-



A Dornier Do18K flying boat brought down during an attack on our Fleet.

The crew of the Do18K (below) preparing to launch their rubber dinghy. It was a flying boat of this type which, in 1938 made a catapult-launched non-stop flight from Start Bay, Devon, to Caravellas on the coast of Brazil, a distance of 5,220 miles. The type is fitted with two Junkers diesel engines

WAR IN THE AIR (CONTINUED)

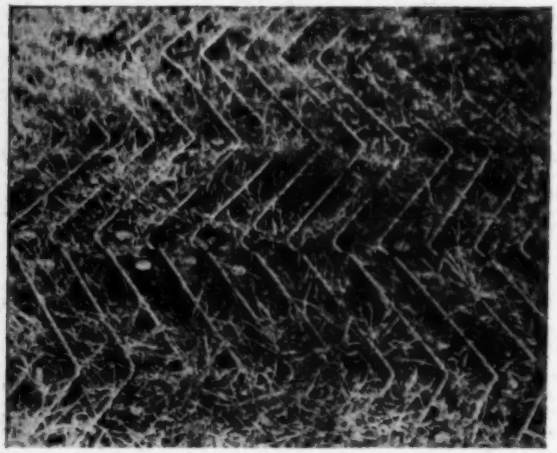
R.A.F. Official photograph, Crown Copyright.

Enemy territory photographed by the R.A.F. The small town of Volklingen near Saarbruecken.

mation in good time that this raid was only a small one of twelve or fourteen machines, and that it was making for the Firth of Forth. It was an obvious commonsense deduction that the attack would be aimed against the Fleet and not against the city of Edinburgh. The decision was therefore taken not to sound an air-raid warning. When a warning is sounded all productive work in a large area is brought to a close and the cessation may last for two or more hours. It is quite possible that the country could lose several millions of man-hours and that this loss would actually be greater than any damage which a dozen bombers could do. One has to consider all these questions from the point of view of winning the war, and many authorities have commented on the fact that in the last war the greatest harm done to us by the German air raids was the interruption of work at munition and other factories. Of course, in making such a decision the chances of civilian casualties have to be taken into consideration, but when it was quite obvious that the attack would be directed against the Fleet and not against the city, the decision to keep the sirens quiet seems to have been very judicious. No doubt the Fleet was given due warning of what it had to guard against.

It seems, however, that the sensation caused by this decision not to sound the warning produced a reaction, for the next day, Tuesday, October 17, air-raid warnings

WAR IN THE AIR (CONTINUED)



Making it hard for the R.A.F. A network of steel laid on the surface of an aerodrome at the front makes a serviceable runway of a soft aerodrome.

kept sounding up and down the east coast as German aircraft approached one point or another. At 10 a.m. four machines made for Scapa Flow and dropped some bombs, two of which fell near the obsolete battleship *Iron Duke* and caused some damage. One German machine was shot down in flames, and it is believed that another was damaged. The *Iron Duke* is an old battleship which was demilitarised under the London Naval Treaty of 1930, and had had all her armament removed. She has since been used as a depot and training ship. The second raid on the Orkneys lasted from 12.30 p.m. to 2.30 p.m., and was carried out by ten machines. No damage was done, and there were no casualties. One German machine was reported to have been destroyed. At 2 p.m. two enemy bombers were heard over Caithness. Bombs were dropped in the Pentland Firth, and a Belgian trawler had a narrow escape, but was not struck. The raiders came under the fire of our guns, and were attacked by our fighters. One was brought down in flames and fell near the Isle of Stroma in Pentland Firth.

During the morning the steamer *St. Ola*, of 231 tons, was attacked as she was steaming near Thurso, but was not hit. Following this attack a German aircraft was brought down by anti-aircraft guns on the land.

The Prime Minister summed the matter up in the House of Commons by saying: "In the air battles of the last two days over our own coasts we have destroyed eight enemy aircraft without losing a single machine of our own. It is believed that several more bombers may have failed to reach home. The total aircraft taking part in the raids did not exceed thirty, and the casualties we have inflicted must certainly exceed twenty-five per cent., and may have been more."

More Futile Raids

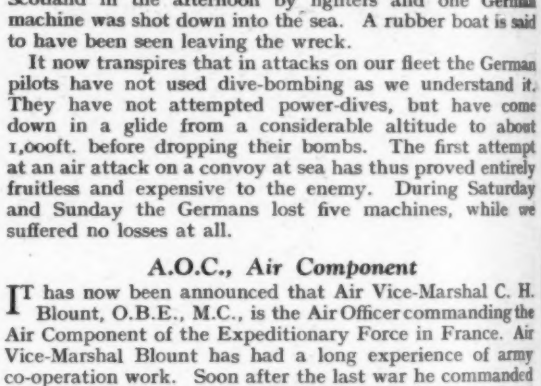
TWO German airmen, survivors of a crew of four from one of the German bombers which was shot down on Tuesday, landed at an isolated spot on the Yorkshire coast on Thursday after drifting for nearly two days in the North Sea in a collapsible rubber dinghy. They were in an exhausted condition, and one had leg injuries. Their machine was one of two bombers which had been shot down by fighters off the coast, and the crew of the other machine had been rescued. One report says that the dinghy came ashore at the foot of the cliff, and the unwounded man climbed the cliff to get help. A special constable named George Thomas said that he saw this man standing at the entrance to a tunnel near Whitby. He ran after him and caught him, and the man did not struggle. Both Germans were taken to a hospital in Whitby.

On Wednesday, October 18, and Friday, October 20, German aircraft attempted to reconnoitre Scapa Flow and the Firth of Forth, but no bombs were dropped and no interceptions were made. On Saturday, the 21st, a convoy of ships in the North Sea was twice attacked by German bombers. First some bombers appeared flying high and they came down low over the escort ships, which immediately opened fire. One enemy aircraft appeared to be hit. A message was sent to the mainland and fighter machines came out rapidly and engaged the enemy. About two hours later a second raid occurred and several German bombers attacked one of the escorting ships, flying in line astern and coming low. Again fighters were summoned out from the shore. As a result of the two engagements three German machines were shot down by our fighters and a fourth was obliged to alight in the sea. No bombs hit any of the warships or of the ships in the convoy. The same day five German survivors were picked up by trawlers and landed at Grimsby. Two, both badly injured, were clinging to the wing of their bomber, and the other three, one of whom was injured, were in their rubber boat. On Sunday, October 22, more German machines approached the East Coast but did not cross inland or drop bombs. They were engaged off the coast of Scotland in the afternoon by fighters and one German machine was shot down into the sea. A rubber boat is said to have been seen leaving the wreck.

It now transpires that in attacks on our fleet the German pilots have not used dive-bombing as we understand it. They have not attempted power-dives, but have come down in a glide from a considerable altitude to about 1,000ft. before dropping their bombs. The first attempt at an air attack on a convoy at sea has thus proved entirely fruitless and expensive to the enemy. During Saturday and Sunday the Germans lost five machines, while we suffered no losses at all.

A.O.C., *Air Component*

IT has now been announced that Air Vice-Marshal C. H. Blount, O.B.E., M.C., is the Air Officer commanding the Air Component of the Expeditionary Force in France. Air Vice-Marshal Blount has had a long experience of army co-operation work. Soon after the last war he commanded No. 4 (Army Co-operation) Squadron, and subsequently he was in command of the School of Army Co-operation at Old Sarum. He has only recently been promoted to the rank of Air Vice-Marshal. Judging from his record, one can say that no better officer could have been chosen for this important command.



The answer is in the negative. A member of the crew of a Fairey Battle passes the exposed plates to a photographer for development. Curiously enough, this particular photographic Battle bears the letters "M.Q."

THE WAR IN THE AIR (CONTINUED)

Air Minister in France

SIR KINGSLEY WOOD, Air Minister, visited the Royal Air Force in France on Wednesday, October 18.

He received the war correspondents attached to the R.A.F. in France and made a statement in the course of which he told them that units of the R.A.F. had been operating in France since the outbreak of war. To a considerable extent the personnel and stores were transported from England by air. They were flown over from England without any mishap whatever, except one comparatively small accident to a single machine. The units were maintained and fed by air for something like twelve days after the outbreak of war. Flying personnel—both pilots and air crews—had been obtaining experience of the country over which they had been operating on both sides of the line. "I have seen for myself," said Sir Kingsley, "the magnificent photographs which have been obtained of the Siegfried Line, and have met and talked to the pilots and crews of the squadrons concerned. I cannot speak too highly of the fine quality of the pilots and of the aircraft in which they have carried out their work." He went on to remark that we had complete flying hospital units for the evacuation home of casualties and patients. In addition, the medical services had under their control a complete system whereby in an emergency blood transfusion units could be carried by air right into the front line and, if necessary, blood transfusion operations could be practised while the patient was being carried in air transport.

Hedge-hopping

IT is not only British correspondents who write up accounts of fighting incidents on the Franco-German front in a sensational manner. A Dutch paper has published a story which purports to be told by a German pilot of a fighter machine who shot down a British reconnaissance machine on Tuesday, October 17. He is quoted as saying: "It was a mad chase such as one could hardly imagine; the British pilot was extremely clever. Almost on the ground he used every small hill, every house and even every slope to obtain cover from me. I went racing after him. The Englishman actually flew between trees, and I could see the branches and leaves fly as he went through them. I was sure that his machine was going to tear off the roofs of some of the houses as he roared over the buildings at nearly 200 m.p.h. It was such a crazy adventure that sometimes both of us were only just above the ground, and anyone seeing it from a distance would have thought that the British machine was actually running on the ground. Every time the pilot rose just a few feet to clear some obstacle I fired at his machine. At last the fight was over; I saw the machine in a potato field on fire. I saw three Englishmen get clear of the blazing machine as I circled overhead. One of them waved to me and shook his hands over his head as if to say that it was a fair fight, and I waved back and flew home." He also stated that the British pilot had not time to lower his wheels. One might remark that when one has to come down in a potato field one can do so with much less danger when the wheels are retracted. As our contributor "Indicator" wrote last week, "A belly landing can be made without personal damage in almost any reasonable terrain, and the braking effect is far better than any provided by even Messrs. Dunlop or Bendix." Also, when a pilot lands in enemy country, it is his duty to set his machine on fire if he can.

A German Attack

ON the Franco-German border the Germans commenced an attack of some magnitude at the beginning of last week. General Gamelin evidently declined to lose many men in holding positions which were not of vital importance, and he withdrew his advanced posts methodically in the direction of the main defences of the Maginot Line. This retirement was effected with a minimum of loss to the French, who, however, inflicted considerable casualties on the advancing Germans.

Further reconnaissance flights over western and north-western Germany have been carried out by British aircraft. On Tuesday, October 17, one of our machines did not return, and a report from Amsterdam says that a German fighter had damaged it and forced it to land near Lingen close to the Dutch frontier. It struck a farm building and caught fire. Three airmen jumped from the machine at the last moment and were taken prisoner, all unhurt.

U-boats Bombed

TWO attacks on U-boats were recently made by R.A.F. aircraft and both are believed to have been successful. One took place in the North Sea, and the other in the Atlantic, many miles from the aircrafts' basis.

The following is the pilot's report of the North Sea attack:

"A reconnaissance aircraft sighted and attacked a submarine in position . . . A salvo of anti-submarine bombs was dropped ahead of the periscope. The submarine dived steeply. The air-gunner said definitely that he noticed a second underwater explosion after the explosion of these bombs. The aircraft then turned about, flew over the submarine a second time, and dropped a second salvo. Patches of oil were observed after the first salvo and, more extensively, after the second attack. Nothing more was seen of the U-boat."

The pilot of the Atlantic patrol aircraft said:—

"An enemy submarine was sighted some distance away. It dived and several heavy bombs were dropped on it; the first is thought to have been a direct hit. Dark objects appeared in the water after the attack, and air bubbles rose to the surface. A second bombing attack was made as near to the same position as possible. We circled over the area for some time, but nothing further was observed."

Another squadron of the A.A.F. has won distinction and done extremely useful work. The squadron in question is one for general reconnaissance belonging to the Coastal Command. A large convoy of merchant ships was moving through the North Sea through an area believed to be clear of mines. The sea was rough and in such circumstances the detection of floating mines required careful and skilled observation. Machines of the A.A.F. squadron twice spotted mines directly in the path of the leading ships and quite close to them. On each occasion the aeroplanes dropped smoke flares as markers within a few feet of the mines, and flashed warnings to the convoy by signalling lamps. On the first occasion the ships' helms were thrown hard over and the convoy was led by one of the aircraft on to a new course. On the second occasion there was just enough time for an escorting destroyer to steam across the merchantman's course and destroy the mine by machine gun fire.

ENEMY AIRCRAFT

A MUCH APPRECIATED *FLIGHT* FEATURE

GREAT value has been placed upon the exclusive series of drawings and data published in recent issues of *Flight* of German military machines.

This series commenced in the issue of September 21 and has been in great demand in military and civil centres. For the guidance of those who have not studied the whole series we quote below the dates and subjects:—

THOSE HEINKEL BOMBERS	September 21
GERMANY'S DIVE-BOMBERS	September 28
FIGHTERS OF THE *LUFTWAFFE*	October 5
THE JUNKERS BOMBERS	October 12
SOME GERMAN SEAPLANES	October 19

BREAKING OUT AGAIN

"A. Viator" on the Resumption of Civil Aviation

IT is really refreshing to have some news of Civil Aviation to write about once more. Incredible though it may seem, there are a few of those in high places who dislike it. They made up the curious yeasty ferment they would refer to as their minds, that all civil flying would cease at the outbreak of war and that, but for an occasional boat, this country would be indeed an island, except for an odd visit by an unwelcome enemy aircraft.

Quick communications, which are vital to the business man, were cut off by these pundits with relish, and business people were compelled to risk endless journeys by occasional steamers. Apart from the risk of mines and torpedoes there was, for the Britisher anyway, the risk of being grabbed and incarcerated in a German prison camp where, it is little enough consolation to know, one would be as free as anyone else in the country.

Now K.L.M. to Holland and Sabena to Brussels have started regular daily services, and Jersey Airways, Ltd., have also commenced twice-daily services from Jersey and Guernsey, which unhappy isles were, it is vaguely reported on impeachable authority, rapidly becoming cut off from civilisation and going all neolithic so that men began to boil stew in their bowler hats and wear tureens on their heads. Worst of all, they forgot what beer was for and scrubbed their floors with it.

I understand the Danish Company will shortly be starting up, and there are persistent rumours of an A.B. Aerotransport, Swedish service.

Now all these services which are operating are carrying full loads of business men who don't care for long swims in the cold grey seas, pestered perhaps by enemy aircraft who mistake their bobbing bowler hats for submarines. A journey by air to the Continent takes only a couple of hours, and as trade follows the trader these business men are of vital importance.

Propaganda—

Another point which the Ministry of Information (if any) and the Ministry of Propaganda, if we have one, might note, is that these services to the Continent are carrying large quantities of British newspapers. Until the neutral air companies were permitted to operate, German newspapers reached Holland, and probably Belgium too, on the day of issue, whereas British papers often arrived there four days later. What is the use of newspapers four days old in a neutral country which is bound, more or less, to form its opinions from the regular daily newspapers which are obtainable?

If the people who concern themselves with these affairs would visit an airport and hold friendly converse with neutral air travellers they would realise, as I have done lately, how this lack of British newspapers has affected neutral opinion.

Air travellers are simply swarming round the travel agencies booking tickets, and there is a regular Blitzkrieg for Lebensraum on all machines. It is not so simple as it used to be to travel by air, and travellers are advised to have all their permits and other documents in order, to avoid carrying books and newspapers which are forbidden, and to place all their business documents in one despatch case to simplify examination.

A good many extra departments are now concerned with travel, and I'm not sure the latest is not the Ouse Catchment Board, whose function, as the name implies, is the catchment of spies and the prevention of secrets oozing out.

One new feature of air travel is that cabin windows are now rendered opaque with pearl-grey paper, or sprayed dope, and it has been suggested by a ribald pal that some artist should be employed to decorate these illuminated panels—for such they are when seen from within the cabin—with illustrations à la *Vie Parisienne*.

These services are, of course, operated from a frightfully secret airport, and the passengers all enter into the spirit of the game, even the regular ones, and pretend not to recognise the countryside, when travelling to and from the nearest railway station.

As one traveller from the States remarked on landing: "Say. Can you tell me what country I'm in—I shore am puzzled?" Of course, I was not allowed to tell him, but he rather meanly looked at his ticket and found out, and bang went the Defence of the Realm Act.

Another traveller approached the restaurant waiter and hissed: "Sh —— or 'am?" When asked what he meant, he said: "Maybe, like in Germany you are not allowed to mention beef, so what I meant was "Any beef or 'am?" Having got both, with lashings of real bread and butter, he realised he was in England. Most disturbing how they find out, isn't it?

—and Humbug

Radio Hombog caused momentary consternation in a western city by insisting, in a patently ersatz Oxford accent that the *Mauretania* was sunk. Later a high official from the western city contradicted this in faltering tones, sitting, as he spoke, on the floor of one of the numerous *Mauretania* bars.

"It's true it's rocking," he remarked, "and we seem to be in a whirlpool, but the goo' ole *Mauretania* is founded on rock. S'matter of fac' s'all a mistake. It's me that's sunk." It also announced that Goering, finding the Messerschmitt a bit of a Lesserschmitt, is looking round a trifle wildly for a Besserschmitt. He will need it.

Then there was the perfectly authentic bit about "vegetable noodles" as a main dish for German hausfraus for Sunday dinner. I can't think what they are, but Hombog should watch its step. Why, it's darn nigh high treason when the Führer is a vegetarian and a bit weak in the head as well, poor little man. Bubble and squeak is nice too—if it doesn't merely mean a brisk walk down a wet strasse in ersatz leather shoes.

Dr. Funk, alias Herr Wertical-Vindupp, has been amusing as well lately. He says: "Look at the measures enemy countries have taken to meet the economic consequences of the war, and you will see a complete dislocation of economic life such as is quite unknown in Germany." The Herr Doktor is quite right, for the new price of whisky—completely unknown in Germany—has properly upset my economic life.

A. VIATOR.

Nippon in Tokyo

AFTER successfully completing its goodwill flight around the world, the Japanese monoplane *Nippon* returned to Tokyo on October 20. After crossing the South Atlantic the *Nippon* followed a route well to the south of the present "centre of disturbance" in Europe. The flight was an uneventful one.

K.L.M. is Twenty

HOW time does fly! Who would believe that on October 7 it was 20 years since the K.L.M. (Royal Dutch Airlines) was started? Owing to the international situation there were no celebrations on that date. This statement, from a correspondent in Holland, may appear a little obscure until it is pointed out that the K.L.M.'s technical staff is now working with the Dutch army. Of the 1,100 men employed by the company some 300 have been called up in the army, and about 150 are working in other trades.

The new K.L.M. head office in The Hague, now under construction, will be finished early next year, but it is doubtful that the company will occupy it. Probably the office will be let to the Government. In the meantime, the company runs a twice-weekly service between Naples, Italy and Batavia, Dutch East Indies. All being well, the service will be increased to three times a week. It is hoped to get French permission to send three Douglas DC3 machines to Naples. At present six of these machines operate between Naples and Batavia.

"A.C." Types of the LUFTWAFFE

A Henschel Hs 126 practising low reconnaissance over a heavily wooded district.

Reconnaissance and Observation Aircraft : A Practical "Freak"

By H. F. KING

SOME of the earliest squadrons of the German Air Force were allocated army co-operation duties. Using two early types of Heinkel (the He 45 biplane with B.M.W. VI vee-twelve and the He 46 monoplane with Siemens Sh. 20B radial) and equipped with wireless and cameras, these units set about practising their highly specialised work.

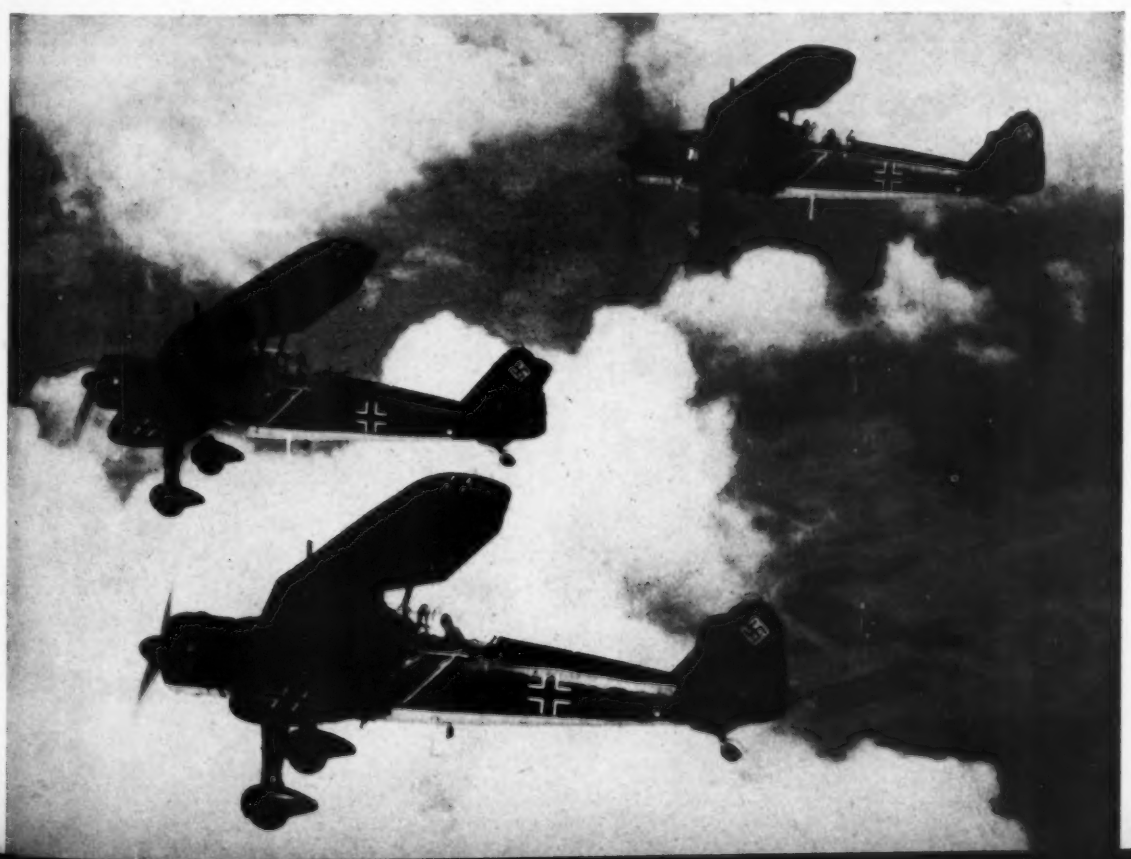
The Heinkel He 46 was a parasol monoplane and was favoured because of the almost unrestricted field of downward view. Accordingly, the next army co-operation type to be put into series production—the Hs 122—was designed along similar lines, though it was a product of the Henschel concern of Johannisthal and Schönefeld. The Hs 122 was fitted with various engines from the Siemens SAM 22 radial to the Rolls-Royce Kestrel and Junkers Jumo 210 water-cooled in-line units.

Henschel Hs 126

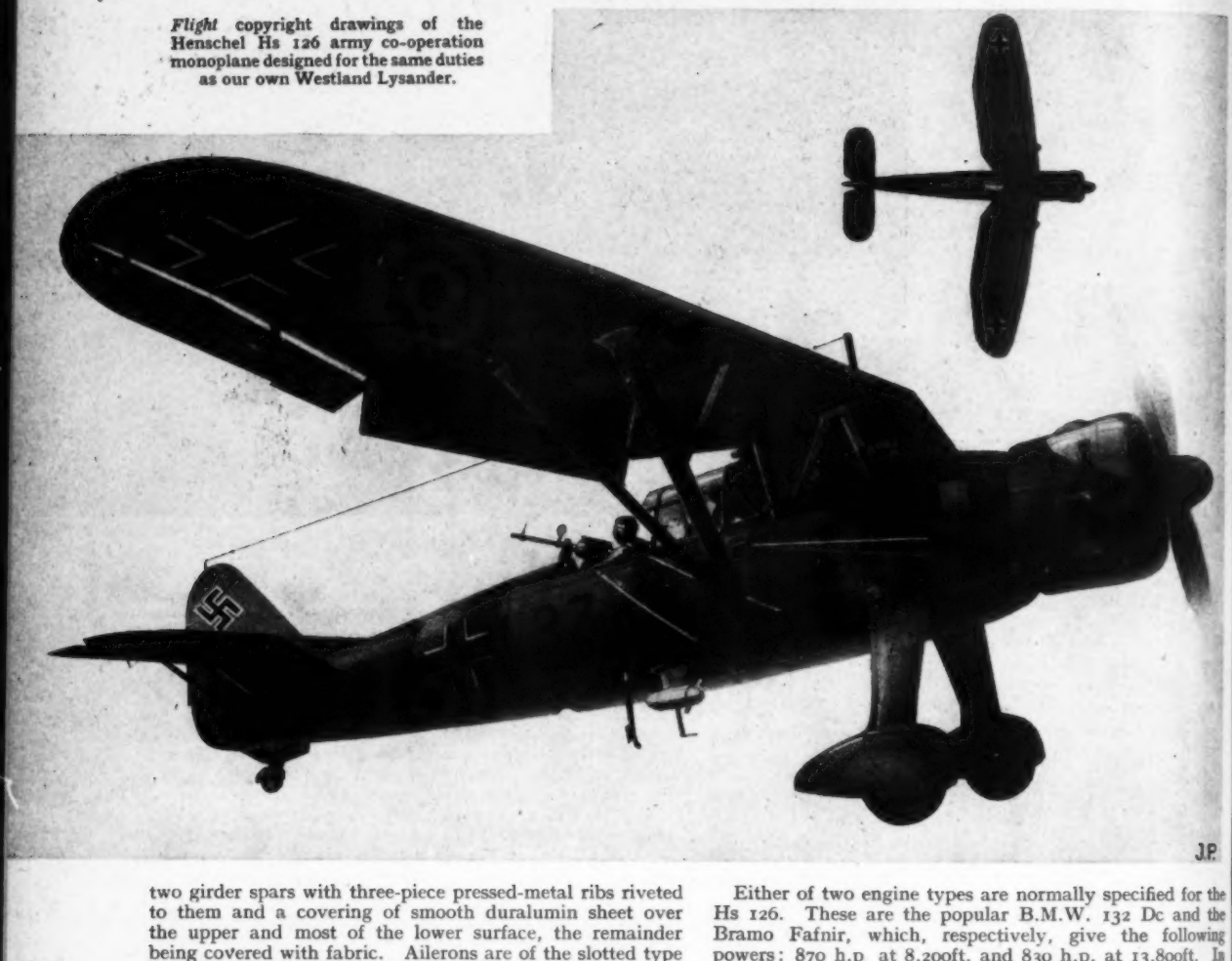
From the graceful Hs 122 was developed the Hs 126, which incorporated many refinements and which is now the standard single-engined machine in service.

The Hs 126 is a parasol strut-braced monoplane with a swept-back wing and a fixed undercarriage. Built in two sections which are joined on the centre line, the wing has

A formation of Henschel Hs 126s. This machine is probably the most easily recognised of all the German service types.



Flight copyright drawings of the Henschel Hs 126 army co-operation monoplane designed for the same duties as our own Westland Lysander.



two girder spars with three-piece pressed-metal ribs riveted to them and a covering of smooth duralumin sheet over the upper and most of the lower surface, the remainder being covered with fabric. Ailerons are of the slotted type and have metal frames and fabric covering. Trailing-edge flaps are of the camber-changing type, fitted inboard of the ailerons, and extend as far as the large vee-shaped cut-out in the centre section. Flap operation is hydraulic. The main bracing struts are vees, but the central struts are of N formation.

A stressed-skin metal monocoque structure, the fuselage is of oval section, the forward portion being liberally supplied with detachable panels. The cockpit enclosure is roomy and has the usual sliding-cowl arrangements.

The tail is fairly conventional, but the tailplane is attached to the fin and not to the fuselage proper, being braced by four struts. Like the ailerons, the movable surfaces are balanced statically and aerodynamically and are provided with trimming tabs.

A characteristic feature of the Hs 126 is the single-strut cantilever undercarriage, which is reminiscent of that on our own Gloster Gladiator and Westland Lysander, though it does not take advantage of Mr. Dowty's internally sprung wheels. Actually, shock absorption is provided mainly by annular springs of the Verdinger type, which are fitted in the fuselage. The undercarriage legs are of steel and are streamlined by tapered light-metal fairings.

Either of two engine types are normally specified for the Hs 126. These are the popular B.M.W. 132 Dc and the Bramo Fafnir, which, respectively, give the following powers: 870 h.p at 8,200ft. and 830 h.p. at 13,800ft. In either case the engine is installed in a long-chord cowling with controllable gills and drives a three-bladed V.D.M. variable-pitch electrically operated airscrew about 11ft. 9in. in diameter. The choice of the Fafnir fully supercharged engine is interesting, as in this country single-engine army co-operation aircraft are fitted with medium-supercharged units.

The machine can be equipped for reconnaissance, artillery observation, light bombing, or the laying of smoke

Using a hand camera from the rear cockpit of a Henschel Hs 126.

A Fieseler Storch, of the type which is used for certain army co-operation duties, showing its liberal supply of slots and flaps and the specially designed undercarriage.

screens, all of which duties can be performed by day and night.

One fixed machine gun with 500 rounds is mounted in the top cowling and is synchronised to fire through the airscrew. This is always provided for the pilot, while the standard armament for the observer is a free machine gun on a pillar-type mounting. Magazines holding a total of 975 rounds are carried for this gun. Two-way wireless is installed as part of the permanent military load; there are fixed and trailing aerials and a windmill-type generator on the starboard side of the fuselage.

When used for photography the Hs 126 carries a big Zeiss camera in the rear part of the fuselage, and has stowage for a small hand camera with 300 exposures.

At the expense of the photographic load two bomb racks, each accommodating five 22-lb. bombs, can be installed. These require special jury strutting.

In place of the bombs, apparatus for laying smoke screens can be attached to the racks.

It is said that the Hs 126 is very easy to fly, an essential requirement in a machine of this type, and photographs have been published of the observer doing photography while the machine flies slowly with flaps down.

Data for the Hs 126 when fitted with the Bramo Fafnir 323 fully supercharged engine are as follows:—

Span	47ft. 6¾in.
Length	35ft. 7in.
Wing area	340 sq. ft.
Weight, empty	4,981 lb.
All-up weight (as photographic machine)	7,099 lb.

The following performance figures relate to the machine as a photographic aircraft:—

Top speed at sea level	190 m.p.h.
Top speed at 6,560ft.	209 m.p.h.
Top speed at 16,400ft.	230 m.p.h.
Climb to 6,550ft.	3.5 min.
Climb to 13,100ft.	7.4 min.
Climb to 19,700ft.	11.7 min.
Service ceiling	26,410ft.
Range at 13,100ft. at 194 m.p.h	620 miles.
Take-off run (to 65ft.)	323yd.
Landing speed	56 m.p.h.
Landing run from 65ft.	453yd.

The Hs 126 is said to be a good production job, which is due in a large measure to extensive use which has been made of castings and pressings.

Fieseler Storch (Fi 156)

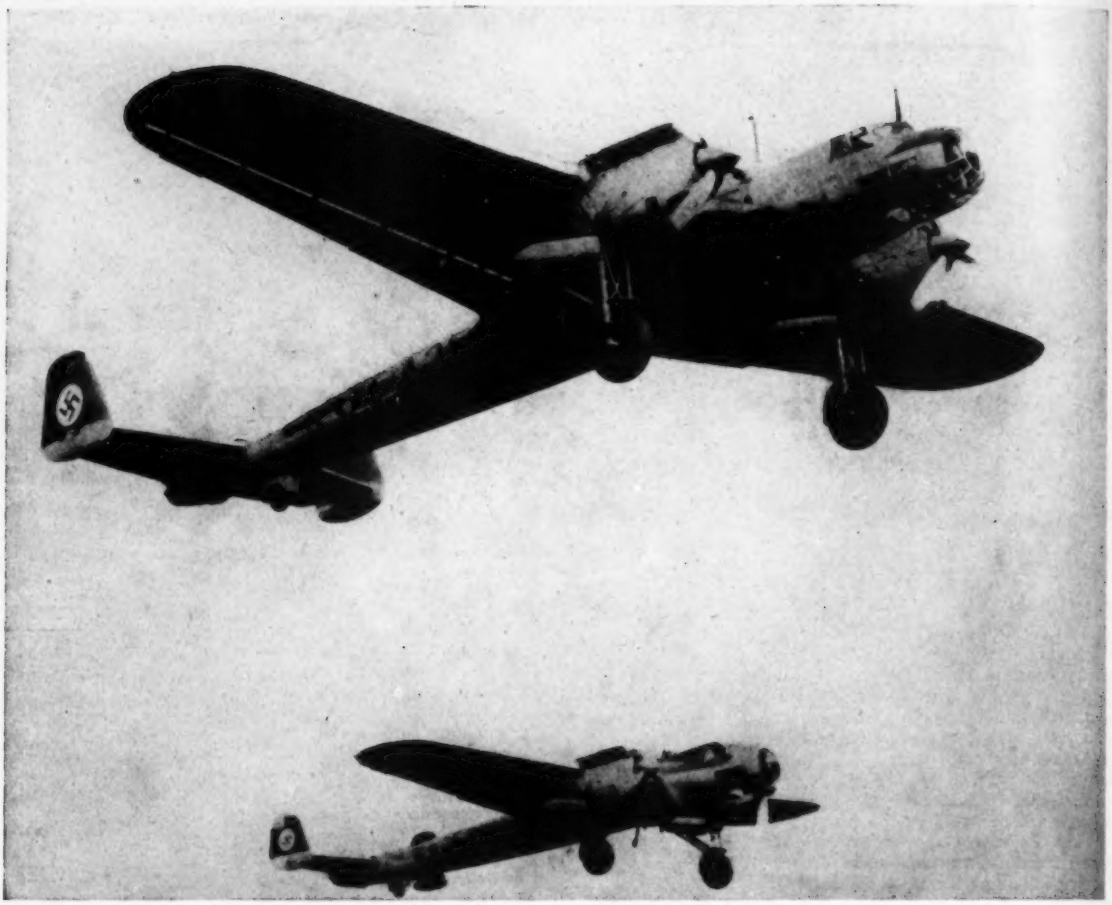
It was to be expected that the Technical Branch of the *Luftwaffe* would not overlook the peculiar qualities of the Fieseler Storch. This is an unpretentious, though somewhat bizarre-looking, three-/four-seater high-wing monoplane which is noted for its slow-flying capabilities and ability to operate from confined spaces.

The wing panels of the Storch are rectangular in shape and are hinged to the top longerons as in the De Havilland Puss Moth, enabling the roof of the cabin to be made completely transparent. The panels are braced to the fuselage by V struts and are arranged to fold round the rear-spar hinges.

A fixed slot extends over the greater part of the leading edge. This is of light-metal construction, though the wings themselves are of the conventional two-spar wooden type. Certain models of the Storch are fitted with movable slots, but in either case the entire trailing edge is hinged and divided, the outer sections functioning as ailerons and the inner ones as flaps. The ailerons are statically balanced.

Welded steel tubular construction is used for the rectangular-section fuselage. This is mainly covered with fabric, but the cabin is very generously supplied with transparent panelling, the side

A Fieseler Storch in a characteristic take-off attitude.



Typical of the larger twin-engined aircraft used in the *Luftwaffe* for strategical reconnaissance are these Dornier Do 17s. The machines shown are fitted with B.M.W. VI engines ; later types have Daimler-Benz inverted Vs, B.M.W. 132s or Bramo Fafnirs

windows being actually outboard of the sides of the fuselage, thus giving more room and better downward vision through the connecting panels. Incidentally, view has been almost as carefully studied in the design of the Storch as its take-off, landing and slow-flying qualities.

In view of the slow, steep landings permitted by the high lift devices the undercarriage of the Storch is specially robust. Essentially it consists of two long-stroke compression legs which connect at their upper ends with two pyramid structures built out from the sides of the fuselage, while their lower ends are connected to the fuselage by vee struts.

As issued to army co-operation units of the *Luftwaffe* the Storch is fitted with a 240 h.p. Argus As 10 C engine. This is an air-cooled inverted vee-eight unit and is fitted on a mounting of welded steel tubes.

The span of the Storch is 46ft. 9in., the length 32ft. 6in. and the wing area about 280 sq. ft. According to figures issued by the manufacturers the empty weight is 1,890 lb. and the all-up weight is 2,910 lb.

Slow Flying

When movable slots are fitted a top speed of about 130 m.p.h. is obtainable, though the fixed slots cut this down to 108 m.p.h. This poor performance at the upper end of the speed range is the penalty for the low minimum speed of 32 m.p.h. and the landing speed of just over 25 m.p.h. An absolute ceiling of 19,300ft. can be reached and the initial rate of climb is 945ft./min. In a wind of about 8 m.p.h. the take-off run is just over 50 yards and the landing run in the same wind and using the brakes is 17½ yards, all of which means the Storch is a very useful machine to have around an army co-operation squadron.

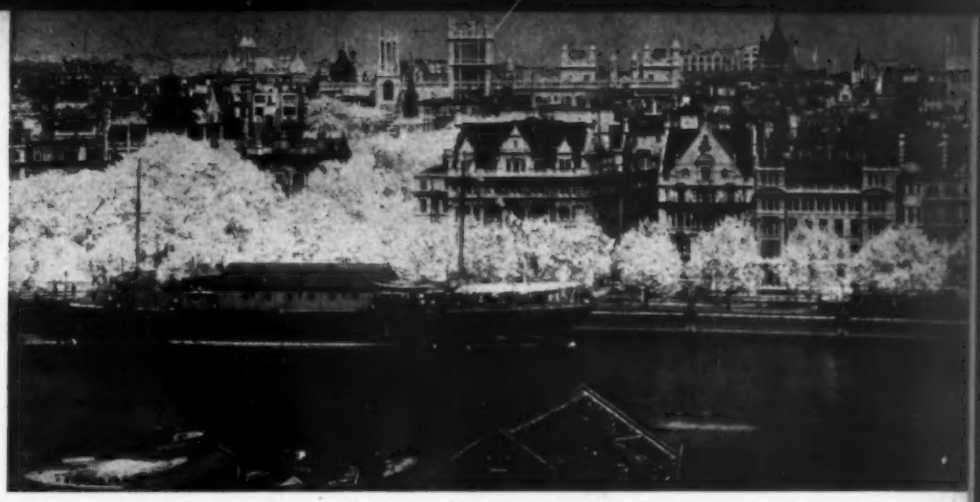
Although, as we have seen, the Henschel Hs 126 has quite a useful performance its range, speed, and armament are insufficient for strategical reconnaissance duties which may carry it a considerable distance beyond the enemy lines. Accordingly, the *Luftwaffe* employs for this purpose faster and larger twin-engined machines.

According to information that came out of Germany some little time back the most commonly used type is the earlier version of the Dornier Do 17 fitted with two B.M.W. VI upright vee engines.

As these units are unsupercharged the machine's performance is quite low, particularly at altitude. It is to be assumed, however, that the later versions with Daimler-Benz DB 600, B.M.W. 132 Dc and Bramo Fafnir radials have superseded the earlier version. The Dornier 215 (a development of the Do 17 with DB 601s or the B.M.W. or Bramo radials mentioned) must also be assumed to be in service for reconnaissance duties as must the Heinkel He 111.

The later types of twin-engined machines, particularly the Dornier 215 and the "short-nosed" He 111, are specially suitable as they have a great deal of transparent panelling in the nose for observation purposes.

Obviously, the Messerschmitt Me 110 multi-purpose twin-engined monoplane, referred to in our article *Fighters of the Luftwaffe* published on October 5, would be quite suitable except for the fact that outlook in a downward direction is comparatively poor. In this connection it may be recalled that the French Potez 63, which is very similar in layout, is fitted with a special transparent observation compartment beneath the fuselage when employed on reconnaissance duties in addition to having a transparent panel in the nose.



"Flight" infra-red photograph.

An infra-red photograph taken from the roof of *Flight* offices looking north. Note how the green trees on the Embankment reflect the infra-red and appear almost white. Green paint or dye would not do this.

NATURAL versus "ERSATZ"

The Uses of Infra-red Photographs from the Air

By the Chief Photographer of "Flight"

A NEWS cable from America published recently in this country, pointing out a new use for infra-red photography from the air in detecting camouflage, leads us to quote from some earlier issues of *Flight*.

On September 2, 1932, when publishing what we believe to have been the first air pictures taken by infra-red light, the following comment was made:—

"Grass and foliage generally appear to reflect a great deal of infra-red light . . . It is conceivable that this fact may be found useful in detecting camouflage, as it is extremely doubtful that any green paint or dye would reflect the same amount of infra-red light as the natural greens which surround the object which was intended to be camouflaged . . . It is interesting to speculate on the possibility of rendering the rays visible to the human eye in some way comparable with that in which the fluorescent screen makes the X-rays visible."

In our issue of June 8, 1933, when publishing a picture of Salisbury Plain taken by infra-red photography from a kite balloon, we again took our courage in both hands. We prophesied that in the next war misty conditions would afford little or no cover, as infra-red photographs, which penetrate mist, would be taken every few minutes during such conditions from small kite balloons brought up close.

So much for retrospection. What are the possibilities to-day? Infra-red emulsions are considerably faster now than they were in 1932, and this fact should make air photography possible on a considerable percentage of days. An aircraft taking photographs at intervals, or two balloons spaced some way apart and photographing the same area, should be able to produce sufficient stereoscopic exaggeration, in conjunction with the difference in tone given by the real green and the "ersatz" green to infra-red, to give away any attempt at hiding gun emplacements, shell dumps and such like.

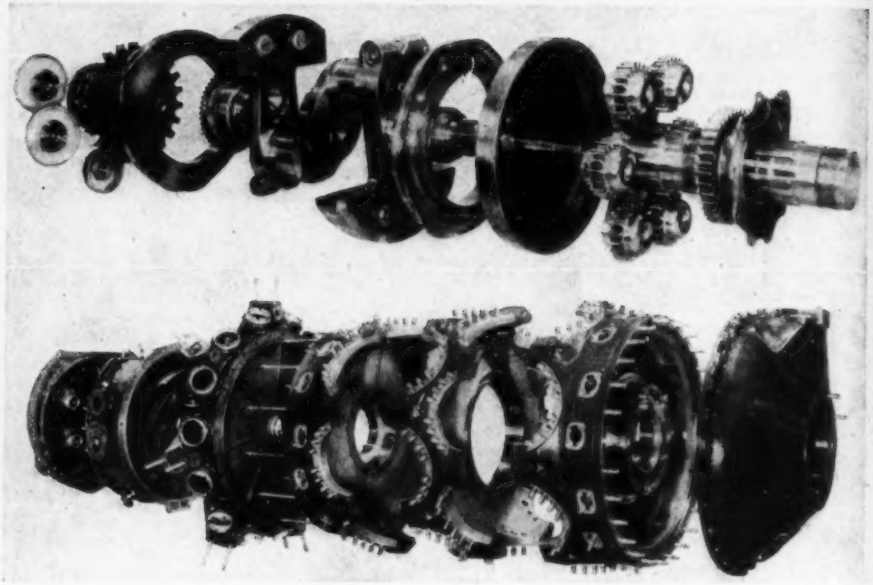
Let us speculate again. Imagine a kite balloon with a television camera in the basket sending its picture in electrical impulses down the cable for brigade headquarters to watch. Infra-red would be used on misty days and the whole spectrum in clearer weather. The balloon would not be steady enough all the time, but there would be long periods when it would be usable. Again, air photography at night has long been possible by the aid of high-power magnesium flares. What the infra-red content of this light is we cannot say, but it may be sufficient to obtain a photograph of sorts of a vital area under adverse photographic conditions.

The picture of Salisbury Plain, first published in 1933, taken with a 16.8" lens from a kite balloon 3,500 feet high. Trees and habitations in the foreground are six miles distant; in the original print animals can be clearly discerned in the fields. The wood, on the right beyond the middle distance, is about 15 miles away.

"Flight" infra-red photograph.

A BIG AMERICAN RADIAL

Details of the Wright Double-row Cyclone 14; 1,600 h.p. for Take-off



The upper view shows that the internal parts of the double-row Cyclone 14 are similar to those of previous Cyclones with the exception of the double-throw crankshaft and the additional cam for the valves of the rear cylinders. Below are the "housing" sections from nose to supercharger.

ALTHOUGH put to immediate commercial use in the Pan-American Boeing Clippers, the new Wright double-row Cyclone 14 radial was retained on the United States Government's "restricted" list as it was adopted by the U.S. Navy for its new Martin flying-boats and by the U.S. Army for various attack-bombers. The engine has now been released for export and the following details have become available.

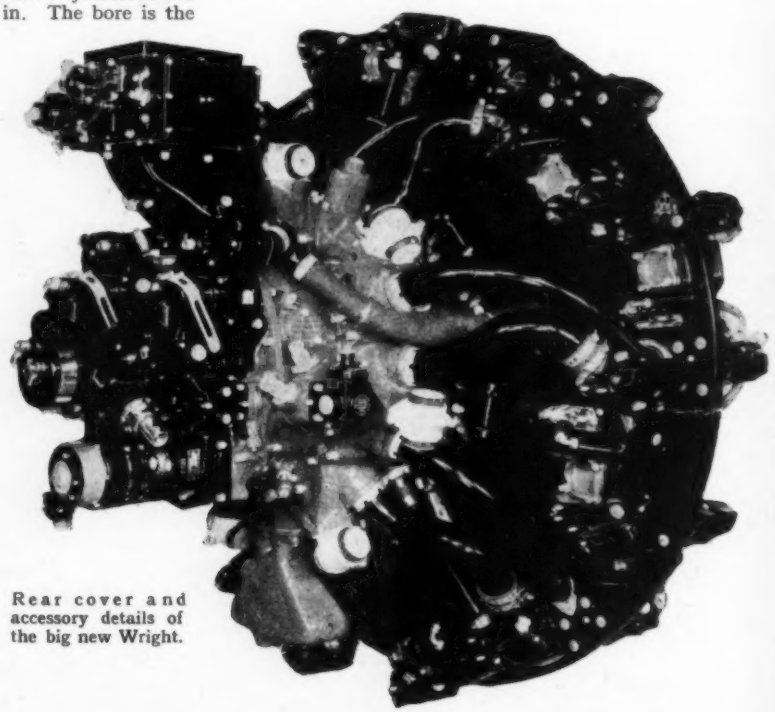
With the exception of the crankshaft and crankcase the basic design remains similar to that of the nine-cylinder Cyclone. The engine is a staggered fourteen-cylinder radial having a total capacity of 2,603 cu. in. The bore is the standard 6.125in. of the single-row Cyclone, but the stroke is slightly shorter, being 6.312in. instead of 6.875in. Like previous Cyclones, the new engine is 55in. in diameter and despite the additional row of cylinders it is little more than a foot longer, including the extension of its accessory section to provide a better passage for the mixture between the carburettor and supercharger. The cylinders follow previous Cyclone practice, but greater cooling area is provided, more, in fact, than for any Cyclones up to the recently announced G-200 series.

The main, or power, section of the crankcase consists of three aluminium forgings divided by planes through the centre of the cylinder locations of each bank. They are bolted together between the cylinders of each bank and contain the three main crankshaft roller bearings in addition to supporting the front and rear cam drive gear assemblies, the cams and the tappet and guide assemblies.

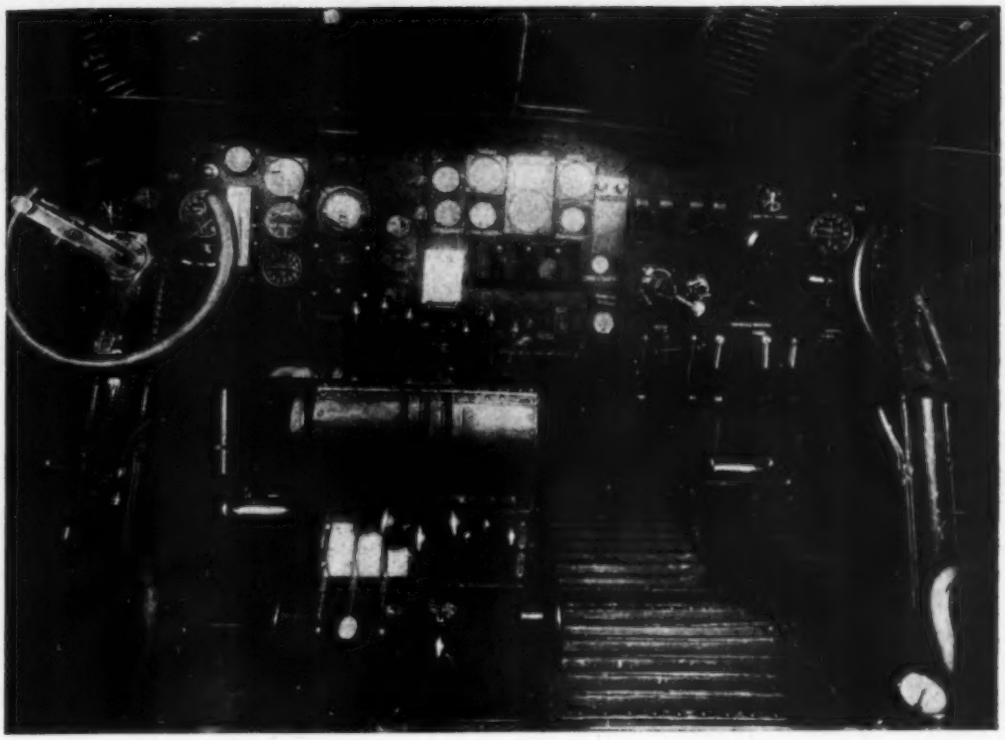
The crankshaft is in three pieces as the Wright engineers favour the use of single-piece master connecting rods. These three pieces are clamped together in the same manner as the parts of the two-piece shaft on the single-row Cyclone.

The supercharger uses a single impeller driven by intermediate gears from the accessory drive shaft. Conventional intermediate gears may be replaced by a two-speed supercharger drive.

Detailed performance figures have not been issued, but it is claimed that the take-off output is 1,600 h.p. and the power "for normal operation" 1,350 h.p.



Rear cover and accessory details of the big new Wright.



PITY the POOR PILOT

A Plea for Transferring Some of the Equipment to the Care of Engineer Officers, Navigating Officers and Wireless Operators

By FRANCIS CHICHESTER

TOO much is demanded of the modern air pilot. He is being overwhelmed with knobs, jobs, dials and levers, and will soon need to be, not a man, but a marvel.

Besides keeping a look-out above, below, in front, and to either side, taking off, flying and landing the machine, he is often expected to be the navigator and flight engineer as well. He has numbers of levers and controls to manipulate—throttle controls; mixture, flap, undercarriage and airscrew controls; automatic pilot controls and electrical switches. On top of all this he has plenty of instruments to watch. On one modern instrument layout I counted no fewer than sixty-four, comprising:—

4 boost gauges,
4 r.p.m. counters,
4 cylinder head temperature gauges
4 oil pressure gauges,
4 inlet oil temperature gauges,
4 outlet oil temperature gauges,
4 carburetter intake air temperature gauges,
4 fuel pressure gauges,
4 fuel pressure drop warning lights.
Radio "homing" dial.
Fuel gauge,
Selector switch for same,
Engine synchroscope,
2 undercarriage up and down warning lights,
2 vacuum gauges,
Cabin temperature gauge,
Volt ammeter,
2 brake pressure gauges,
Flap pressure gauge,
Flap position indicator,
De-icer control,
Rheostat for landing light control,
Pitot heater switch,
Airspeed indicator,
Rate-of-climb indicator.
Altimeter,
Sensitive altimeter,
Clock,
Outside air temperature thermometer,
Lorenz blind landing indicator,
Directional gyro,
Gyro horizon indicator,
Turn and bank indicator,
Compass,
and an automatic pilot with its necessary controls and gauges.

Failure to notice a change in reading of any one of these sixty-four instruments may result in a fatal crash. That there are not more accidents shows what a superman the modern pilot is. But every year more instruments appear, and his burden becomes greater, the tax on his memory and skill heavier.

Even an air pilot has a cracking point. To-day he is kept nearly at it the whole time, with not enough margin to permit him to have a cold in the head or to cough in safety. The time has come to reorganise the aircraft crew and relieve the pilot of all duties and instruments not essential for his job.

The Atlantic flights of Pan-American and Imperial Airways are proving valuable by indicating the trend of crew specialisation. For instance, it has been found better to keep one man at navigation throughout the flight. The old practice was for the pilots to have a shot at navigation every now and then "for a rest." This not only meant that the pilot suddenly had to switch over all his thought processes and his reflex actions to a different job, but it also meant that he must start work at the chart table

without all the other man's stored-up knowledge of weather developments and earlier navigation details.

The new system of specialisation indicates a tendency to follow ship's practice: a steamer is conducted by a number of men, each carrying out his own duties and not interfering with the other man's. Perhaps more can be learnt from marine practice. After all, it has been built up and tried out over a period of several centuries; flying is only a raw upstart by comparison.

A pilot on a steamer is only expected to take ships out of port and bring them in. He must know the channels, obstructions, tides, and must keep a look-out and give the necessary orders. His knowledge of the engines can stop at the engine room telegraph. He need know practically nothing about navigation. He certainly need not bother about celestial or deep-sea navigation or radio. Imagine the horror in Trinity House if he were told to attend to sixty-four instruments, manipulate a dozen or so levers, and control four motors, besides carrying out his piloting duties!

Don't forget that the air pilot must keep a look-out in two planes instead of in only one, and may be travelling at 200 instead of 20 knots. Also, he must be able to take off, fly level, or land his craft in fog and darkness as well as in clear daylight.

Spare-time Interests

He must have a panel of flight instruments, including those necessary for blind flying: an airspeed indicator, rate-of-climb indicator, altimeter, sensitive altimeter, clock, compass dial, directional gyro, gyro horizon and turn and bank indicator, an indicator for radio beam blind-landing, and a radio homing indicator. He will have also a control for switching in the automatic pilot when he requires it. He needs another instrument not mentioned —a barometer or absolute pressure gauge—so that when flying blind he can keep to a certain layer of atmosphere defined by limits of pressure. He also needs a terrain clearance indicator or sonic altimeter.

Unfortunately, he must retain control of the power output of the motors. It might be fatal if there were any time lag in obtaining the power he wants from any motor, especially in landing or taking off. The revolution indicator used to tell him what his motor was giving, but now that airscrews with automatically variable pitch are the fashion he must know the power being applied to each, and at present the boost gauge is the only instrument to tell him. He must also keep the throttle controls, of course.

All the rest of the engine instruments will have to be transferred to the care of an engineer officer, who will have his own panel in an "office" away from the pilot's cabin. He will start the engines and take complete charge of the running of them except for the supply of power which the pilot must control. Incidentally, the sooner the engineer can get access to the engines while in flight the better; he might then be able to effect minor repairs sufficient to get a broken-down motor going again.

The engineer officer will relieve the pilot of about forty instruments for the engines alone. He should also attend to the fuel supply and distribution; take charge of the undercarriage winding gear of a landplane, adjusting it according to the pilot's orders and reporting when it is in the required position; attend to all the electrical equipment; see that the flaps are working properly, and operate the de-icer control according to orders.

He will know the most economical cruising speed and height for his engines under all conditions, so that he can supply the information on request. Lastly, he can look after the automatic control so that the pilot need only give the word when he proposes to switch it in, and will have nothing to do but cut it in or out. Even the pitch trim of the automatic pilot could be left to the engineer.

Navigational Relief

A navigating officer will relieve the pilot of the rest of the instruments and duties. He will take the outside and inside air thermometers. The master compass, which will operate repeating dials for the pilot, navigator, and wireless operator, will be placed where it will be free from any magnetic disturbance able to set up deviation. The navigator will work out the course to steer, and the pilot will only have to follow it, or advise when deviating from it.

The navigator will relieve the pilot of all worry about meteorology, will collect all weather data, consider them in conjunction with the most economical cruising speed and altitude for the motors, and will advise the pilot not only of the best route to follow to dodge bad weather or benefit from good, but also of the best altitude at which to fly. He will also look out for icing-up conditions.

He will undertake all astronomical observations, and, sitting at his fully equipped chart table,* will be able to make accurate drift observations by means of a periscopic drift sight. He may have the radio compass goniometer for obtaining radio bearings; if not, the wireless operator will carry out the goniometry or obtain Q.T.E. bearings as the navigator requires.

Incidentally, the wireless operator is at present the only member of the crew with set specialised duties such as are advocated for pilot, navigator, and flight engineer.

Finally, the time is not far off when large passenger transport aeroplanes will have a captain to command the ship, supervise contact with the base organisations, and administer both crew and passengers during flight. He will probably have served his time as pilot, navigator, engineer, and wireless operator, but he will not have performed two or three of these offices simultaneously, as many pilots are required to do at present.

* See article, "A Square Deal for the Navigator," *Flight*, March 2nd.

Paris and Calcutta

BY now Imperial Airways (or N.A.C.) will, in co-operation with Air France, have reopened a regular service between this country and France. Two daily return services are being run from Heston airport, Imperial using D.H. Albatross or Frobisher class machines and Air France using three-engined Dewoitines. The times of departure and arrival can be obtained either from the companies themselves or from travel agents.

We would have thought that no such service should be run to a regular time-table, since there is always the possibility that wolves would be in wait for large, succulent and quite unprotected sheep—but that is not our business. Either type of machine would require some catching and the route is not, however, likely to be stereotyped.

Frobishers are also being used for the new connection between Alexandria and Calcutta. Both boats and landplanes are already being used for the England-Egypt-India services, and this new service forms an additional connection.

Since air mail is now only being carried at surcharged rates, there is a good deal more room for passengers. Nevertheless, such is the demand, there is a waiting list of something like 700 for the various Empire services.

Reviving Slowly

RECENTLY we recorded the gradual resumption of commercial air services in Europe and on the Empire routes. We also gave an account of the work done by the two Short flying boats *Caribou* and *Cabot* during the months of August and September, when sixteen flights were made across the Atlantic. In addition, Imperial Airways have also recently been operating a flying boat ferry service to connect with the Pan American Airways' Trans-Atlantic service which, since the outbreak of war, has terminated at Foynes, on the Shannon.

On the Empire Air Routes, two services a week are being maintained to Sydney, one to Kisumu and one to Durban, by flying boats. One service a week is also being operated to Egypt, *via* Malta, by landplane, and the possibility of extending it to India is under consideration. The overseas feeder services to these trunk lines have also in general been maintained. This rapid means of communication for passengers, mails, and urgent freight between the United Kingdom and other parts of the Empire and our allied countries Egypt and Iraq is obviously important.

In the European zone, it has been necessary to suspend most of the services. A notable exception has been British Airways' service once weekly to Stavanger, Stockholm and Helsinki.

TOPICS OF THE DAY

NEW IDEAS in NAVIGATION

The Effects of Speed : Cinematographic Map Reading "Indicator" Continues to Learn

THOSE few amateurs who flew machines in the Mew Gull class during the piping days of peace will find nothing very difficult or extraordinary about flying modern military types. Those, however, whose usual travels were carried out at a cruising speed of not much more than 120 m.p.h. will find themselves positively shocked at the way in which the landscape goes by.

In fact, one is torn between two desires—apart, of course, from the usual one of wishing that one was back in the pilot's seat of a Leopard, or something equally docile. The first is to follow landmarks with furious attention, on the principle that, in these days of balloons and prohibited areas, a pilot who is even momentarily lost is in a very difficult position indeed. The second is to fly by D/R almost exclusively because the world goes by so quickly that it is unnecessarily tiring to look for more than the few really outstanding landmarks.

As usual, the best course lies between these two extremes. It is manifestly hopeless to attempt to follow railways all the time, but a compass course plus a few really good and obvious railways and rivers will take one a very long way. A quickly estimated E.T.A., too, will narrow down the area of search if the next outstanding landmark fails to turn up.

At 200 m.p.h. you can cover an awful lot of ground in a straight line if you merely carry on full of hope, but the business of circling some town or village also has its dangers. In our little aeroplanes we used, on occasion, to fly low down and try to read the name on a railway station. You can't do it with these military machines. Not only is it impossible to make sufficiently tight turns to keep the station in sight, but there is a very good risk of spinning the machine in. A little more G and a little less speed and you've dug a very large hole in the ground. In extreme cases of lostness it *might* be permissible to fly at a couple of hundred feet up and down a railway line at full cruising speed, hoping to be able to read the name as it flashes by. The better alternative is to find a good large field, fix its position, and scour the local countryside for something unmistakable.

The real answer, of course, is that you should never be lost. It's easy enough to say it. On practically every cross-country with a slow aeroplane one spends perhaps five minutes without recognising anything in particular—or one is ten degrees off course at the beginning of a flight for a similar period of time. Be it known that in five minutes a 240-m.p.h. aeroplane has covered twenty miles.

Not that I want to exaggerate the difficulty. You get used to the effect of this speed on navigational ideas, but, since it is twice that of the average light aeroplane, you have to be twice as careful. Only last week a very experienced pilot (with myself as the "L" driver inside the fuselage somewhere) lost himself—and we were fifty miles beyond our objective before we crossed a stretch of country with which I was, fortunately, quite reasonably familiar. We got home twenty minutes late after covering an extra distance which would have taken an hour in a club machine. And, of course, none of this cross-country business with fast machines is made any easier by the fact that it is not always permissible to fly straight to one's objective. At least on the eastern side of the country the pilot's travels are tortuous if he is to avoid the possibility of A.A. attention. Even the first warning burst may sink you, and there'll be no one to blame but yourself. The instructions are clear enough.

One of the minor curiosities of "advanced" flying is that some of the contrivances which we once considered to be complicated and difficult are treated almost with too little deference. Furthermore, there are so comparatively few things to attend to that one is convinced that something or other has been forgotten. You go patiently through the "list," however, making a mental note of the fact that two-thirds of them are missing—the "list" being a sort of control inventory, covering hydraulic power, trimmers, mixture (and fuel system), airscrew pitch, flaps and cooling gills. Only the second and third items are applicable to the average small aeroplane. The first thing I shall do when I get back to civil life will probably be to take a Tiger Moth off with the petrol tap shut and the trimming lever in the landing position.

* * *

Last week's special black. The ex-civil pilot, full of flying experience and enthusiasm, but with no Service term to his credit, who thought that the ripcord of his parachute was a carrying handle specially provided by the kind manufacturers. He at least learnt that, when he has to jump, there will be no real need to pull hard. Pretty things, pilot parachutes.

INDICATOR.

FLUTTER SPEED

(Continued from page 340d)

The Damping Derivatives

The flexural and torsional damping terms B_1 and J_3 are both aerodynamic terms proportional to the speed V. It is not proposed to consider elastic hysteresis effects, as it may be shown that in general these are small, especially for heavy wings.

For B_1 we have

$$B_1 = 1.5\rho V l^3 c_o \int_{r=0}^{r=1} \left(\frac{c}{c_o}\right) F(y)^2 \, dy \quad \ldots \quad \ldots \quad \ldots \quad (21)$$

and for J_3

$$J_3 = (0.7 - 1.775h + 1.5h^2)\rho V l c_o^3 \int_{r=0}^{r=1} \left(\frac{c}{c_o}\right)^3 \Theta(y)^2 dy \quad (22)$$

These formulae are derived from R. & M. 1518, but it should be noted that the value for J_3 is of doubtful accuracy. To obtain the numerical part of J_3 it was necessary to extrapolate from results of model tests. It is probable too that there is a "frequency" effect on J_3. For these reasons it is recommended in R. & M. 1839 that allowance should be made for considerable variation of J_3.

We have now obtained all the derivatives necessary to estimate the flutter speed and frequency. It will probably be found best to determine p first by substituting for V in equation 2, as equation 1 yields a simple relation between p and V. The units usually employed are slug-ft.-seconds. ρ is then 0.002378 slugs/ft.^{3} and the flutter speed is in ft./sec.

REFERENCES

1.—R. & M. 1742: The Wing Stiffness of Monoplanes, by A. G. Pugsley.
2.—*Aircraft Engineering*, March, 1938: Resonance Tests. Their History and Principles in relation to Flutter Problems, by A. G. Pugsley.
3.—R. & M. 1839: A Simplified Theory of Wing Flutter, by A. G. Pugsley.
4.—R. & M. 1782: Calculated Flexural and Torsional Flutter Characteristics of some Typical Cantilever Wings, by W. J. Duncan and H. M. Lyon.
5.—R. & M. 1518: Present position of Investigation of Airscrew Flutter, by W. J. Duncan and A. R. Collar.

SERVICE AVIATION

"Flight" photograph.

A DANGEROUS VIEW for the pilot of an "E.A." to have of the Vickers Wellington bomber is that shown above. The tail gunner can easily bring the stern armament to bear.

Royal Air Force and Official Announcements

Casualties

THE Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—Acting Sgt. A. W. Eggington, A/C. 1st Class K. V. Gay, F/O. D. G. Mabey.

KILLED ON ACTIVE SERVICE.—Sgt. J. L. Carter, P/O. J. C. M. Hanbury, P/O. R. L. G. Harker, Cpl. T. W. C. Hopkin, Sgt. C. L. W. Mason, Sgt. J. E. Milne, F/O. D. G. Perry, Sgt. K. G. Sherman.

MISSING.—A/C. 1st Class J. Bateson, F/O. N. C. Beck, Acting Sgt. W. Brown, L.A/C. F. Ellison, A/C. 1st Class T. Fullerton, Sgt. A. E. C. Povey, Sgt. H. H. Turner, A/C. 1st Class A. Wilson.

MISSING, BELIEVED KILLED.—F/O. J. R. Hollington, A/C. 1st Class A. Sill.

MISSING, BELIEVED PRISONER OF WAR.—P/O. D. G. Heaton-Nichols.

DIED ON ACTIVE SERVICE.—Acting Cpl. T. J. Coyle, L.A/C. J. Forbes, F/O. E. A. Marriott, A/C. 2nd Class A. E. Oakley, A/C. 1st Class H. Peart, A/C. 2nd Class W. H. Sanders, A.P/O. J. Scott.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—A/C. 1st Class M. Murphy, P/O. G. W. Sutton.

Fleet Air Arm Entries

THE Admiralty is now not granting commissions for seven years in the Air Branch of the Fleet Air Arm. Entries are accepted in the ratings as "(Hostilities Only) Naval Airman, Second Class." After about six months' training these men are considered for commissions in the R.N.V.R. (Air Section). At present the training establishments are busy with men who applied before outbreak of war or immediately after, in addition to those who are sent up by the Universities' recruiting boards, and there is a long waiting list of men selected. It is, however, possible, that more selections may be considered in the near future.

Royal Air Force Gazette

(Continued from "Gazette" of October 10)

Auxiliary Air Force

General Duties Branch

No. 610 (COUNTY OF CHESTER) SQUADRON.—F/O. M. C. Topham resigns his commission (September 30). No. 905 (COUNTY OF SURREY) SQUADRON.—Capt. B. de L. Cazenove, M.C., is granted a commission as Flying Officer (August 28). The following Pilot Officers are promoted to the ranks and on the dates stated:—*Flight Lieutenant.*—R. W. Holloway (August 29). *Flying Officers.*—H. L. Hutchinson, D. Johnston (August 29). No. 907 (COUNTY OF MIDDLESEX) SQUADRON.—The following are promoted to the ranks and on the dates stated:—*Flight Lieutenant.*—F/O. Sir J. L. Dashwood, Bt. (September 5). *Flying Officer.*—P/O. G. A. Usher (August 10). No. 912 (COUNTY OF WARWICK) SQUADRON.—Flt. Lt. J. V. Garmonsway is promoted to the rank of Squadron Leader and appointed to the command of the Squadron (June 8). No. 914 (COUNTY OF WARWICK) SQUADRON.—The following Acting Pilot Officers are promoted to the rank of Flight Lieutenant on the dates stated:—A. E. Jones (August 13); W. F. Asburey (August 14). No. 915 (COUNTY OF WARWICK) SQUADRON.—J. S. Schilling is granted a commission as Flying Officer (August 29). The following Acting Pilot Officers are promoted to the rank of Flight Lieutenant on the dates stated:—E. C. Lawledge (August 10); P. G. Allday (August 12). No. 916 (COUNTY OF WARWICK) SQUADRON.—Acting P/O. W. Roper, D.F.M., is promoted to the rank of Flying Officer (July 13). No. 917 (COUNTY OF WARWICK) SQUADRON.—Acting Pilot Officer on probation J. A. Parker is confirmed in his appointment and graded as Pilot Officer (August 12). No. 918 (COUNTY OF DERBY) SQUADRON.—E. S. Riley is granted a commission as Acting Pilot Officer on probation (September 2). The following are promoted to the rank of Flight Lieutenant on the dates stated:—F/O. A. T. Lee (July 5); Acting P/O. C. C. Boyd (July 12). No. 919 (WEST LANCASHIRE) SQUADRON.—P/O. G. M. A. Maxwell is promoted to the rank of Flying Officer (August 12). No. 920 (WEST LANCASHIRE) SQUADRON.—P/O. W. Joanes, M.B.E., is promoted to the rank of Flying Officer (August 13). No. 921 (WEST LANCASHIRE) SQUADRON.—P/O. J. C. Fitzgeorge Parker is promoted to the rank of Flying Officer (August 10). No. 922 (WEST LANCASHIRE) SQUADRON.—The following are promoted to the rank of Flight Lieutenant (September 7):—F/O. F. C. Stubbs, Acting P/O. the Hon. J. S. T. Hawke, Acting P/O. N. B. Thomson. No. 923 (WEST LANCASHIRE) SQUADRON.—H. D. S. Heaven is granted a commission as Acting Pilot Officer on probation (September 1). The following are promoted to the rank of Flight Lieutenant (September 7):—P/O. R. S. Bleckly, Acting P/O. J. C. Burgess. No. 927 (COUNTY OF GLOUCESTER) SQUADRON.—C. J. King is granted a commission as Acting Pilot Officer on probation (August 30). No. 931 (HAMPSHIRE) SQUADRON.—R. G. Booth is granted a commission as Acting Pilot Officer on probation (September 1). No. 933 (HAMPSHIRE) SQUADRON.—The following are granted commissions as Acting Pilot Officers on probation (September 1):—E. J. B. Langhorne, Capt. N. F. W. Rockey. No. 942 (EAST RIDING) SQUADRON.—F. A. Minty is granted a commission as Pilot Officer (August 24).

Equipment Branch

Flt. Lt. H. F. Webb relinquishes his commission on appointment to a commission in the Reserve of Air Force Officers (July 31). No. 7 BALLOON CENTRE.—I. R. Taylor is granted a commission as Flying Officer (September 1). No. 925 (EAST LANCASHIRE) SQUADRON.—Capt. A. J. Phillips is granted a commission as Pilot Officer (August 27).

Accountant Branch

No. 925 (EAST LANCASHIRE) SQUADRON.—J. Wilson, M.C., is granted a commission as Pilot Officer (August 30). No. 930 (HAMPSHIRE) SQUADRON.—H. Andrews is granted a commission as Pilot Officer (August 25).

Medical Branch

No. 909 (COUNTY OF ESSEX) SQUADRON.—H. J. Harcourt, L.M.S.S.A., is granted a commission as Flying Officer (August 29).
No. 928 (COUNTY OF GLOUCESTER) SQUADRON.—T. D. R. Aubrey, B.A., L.M.S.S.A., is granted a commission as Flight Lieutenant (August 29). No. 941 (WEST RIDING) SQUADRON.—J. G. Connell, M.R.C.S., L.R.C.P., is granted a commission as Flying Officer (August 17). No 946 (CITY OF GLASGOW) SQUADRON.—A. L. Cowan, M.B., Ch.B., is granted a commission as Flying Officer (August 26).

Royal Air Force

General Duties Branch

The following are granted permanent commissions as Pilot Officers with effect from October 7 and with seniority of the dates stated:—P. H. Baldwin, K. D. Bruce, G. L. Cheshire, B. A. Rogers (January 7, 1938), A. C. L. Akroyd-Stuart, D. F. Braham, O. O'N. Brigin-shaw, M. H. C. Maxwell, A. D. Hopkin, R. W. Whittome (July 7, 1938).

The following are granted permanent commissions as Pilot Officers on probation with effect from the dates stated and with seniority of September 27:—W/O. E. B. G. Masefield, Flt. Sgt. A. Alexander, Sgt. F. E. Barber, Sgt. E. F. Lines (September 27); Flt. Sgt. G. Ash-field (September 28); Flt. Sgt. H. G. Hastings, Sgt. H. G. Edwards (September 29).

J. G. Macdonald is granted a short service commission as Flying Officer on probation in the Supplementary List (October 5); Pilot Officer on probation R. S. E. Aldridge is confirmed in his appoint-ment (September 23); Acting Pilot Officer on probation, J. H. Sanderson is confirmed in his appointment and graded as Pilot Officer with effect from April 15 with seniority of October 15, 1938.

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates stated:—E. W. Court, H. A. Lax, F. A. Pentycross (June 27); R. Garside (July 17); J. A. A. Gibson, B. V. Rees (August 16); R. C. J. Waters (August 29).

F/O. E. R. Berrill is promoted to the rank of Flight Lieutenant (June 1); Sqn. Ldr. W. E. James is granted the acting rank of Wing Commander (paid) (May 24); F/O. A. M. K. Phillips relinquishes the acting rank of Flight Lieutenant (September 2); A.P/O. on probation C. M. Lochhead takes rank and precedence as if his appointment as Acting Pilot Officer on probation bore date July 4, reduction to take effect from September 4; A.P/O. on probation K. C. Ritchie takes rank and precedence as if his appointment as Acting Pilot Officer on probation bore date July 4, reduction to take effect from September 4; F/O. R. I. MacKenzie (Lt., The Sea-forth Highlanders) relinquishes his temporary commission on return to Army duty (May 22) (substituted for notification in *Gazette* of June 13); P/O. L. C. R. Hill is dismissed the Service by sentence of General Court Martial (September 23).

Equipment Branch

The following Warrant Officers are granted permanent commis-sions as Flying Officers on probation with effect from and with seniority of September 18:—S. G. Walker, W. Higgs, A. J. Green, A. E. Davey, T. H. C. Hampton, A. G. Cooper.

The following Flying Officers on probation are confirmed in their appointments (September 12):—A. J. Huggard, G. Rhys, E. J. Vivian, M.B.E.

The following Pilot Officers on probation are confirmed in their appointments (September 12):—A. J. Bangs, E. Banister, G. L. W. Boswell, R. L. Browning, M. D. L. A. Brundle, G. G. Cartridge J. C. Chadwick, R. M. Craig, R. H. Mason, A. MacRury, B. C. Winstone, K. J. Wood.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer (Septem-ber 12):—J. H. B. Blake, S. J. Bryant, B. G. Carfoot, D. N. Corbyn, J. F. Hutton, T. S. Kennedy, J. H. Nancarrow, T. G. Robertson, H. C. Spackman, T. Thomas, G. C. Tidd, J. R. Valen-tine, A. S. Woodgate, L. A. Wear.

Accountant Branch

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—W. C. A. Robinson (September 1); H. R. Harman, T. M. Masters, S. Robinson (Septem-ber 3); E. R. H. Caven, C. P. Evans, W. L. Hughes (September 4); T. P. Abbott, W. Buckley, W. R. Davidson, E. S. Dixon, J. S. Doughty, M. W. Harrison, C. G. T. Lindsay-White, K. L. Mac-donald, W. Mackirdy, A. Moorcroft, W. G. Morgan, J. E. Nevitt (September 7); A. E. Ekins (September 9); C. G. Strachan (Sep-tember 12); J. F. Goldring, R. T. Humphreys, H. H. Jackson, W. Muckleroy, C. A. Pitt (September 13); G. H. Pears, D. R. Yeoman (September 14); F. G. Turner, I. I. Watkins (September 18); H. H. Wright (September 19); W. N. Sarginson (September 20); R. B. Evans, J. R. Pullan (September 27).

The following Flying Officers are promoted to the rank of Flight Lieutenant (Sept. 16):—P. H. Roscoe, W. G. Thorn, C. W. S. Jones.

Medical Branch

Flt. Lt. (Quartermaster) W. King is promoted to the rank of Squadron Leader (August 1, 1938) (substituted for notification in *Gazette* of Nov. 29, 1938); Flt. Lt. (Quartermaster) D. Breen is pro-moted to the rank of Squadron Leader (September 1, 1938); F/O. (Quartermaster) J. Holt is promoted to the rank of Flight Lieuten-ant (Aug. 1, 1938) (substituted for notification in *Gazette* of Novem-ber 29, 1938); F/O. (Quartermaster) L. Jones is promoted to the rank of Flight Lieutenant (July 12); Flt. Lt. A. W. St. C. Greig, M.B., Ch.B., resigns his short service commission (October 3).

Legal Branch

Wing Cdr. E. St. C. Harnett, C.B.E., is promoted to the rank of Group Capt. (October 6).

Commissioned Engineer Officer

Flying Officer on probation E. Blake is confirmed in his appoint-ment (October 6).

Commissioned Signals Officer

Warrant Officer J. E. Spillard is granted a permanent commission as Flying Officer on probation with effect from October 4 and with seny. of June 12.

Memoranda

The permission granted to W. Peniston-Bird to retain the rank of Sec. Lt. which was withdrawn on his enlistment in the Royal Air Force Reserve is restored on his discharge (June 10); the permis-sion granted to J. Joy to retain the rank of Sec. Lt. is withdrawn on his enlistment in the Territorial Army (April 20); the permission granted to H. R. Mayes to retain the rank of Sec. Lt. is withdrawn (May 3); the permission granted to R. Begg to retain the rank of Sec. Lt. is withdrawn on his enlistment in the Auxiliary Air Force (May 25); the honorary commission as Sec. Lt. granted to C. J. Watts-Read is withdrawn on his enlistment in the Auxiliary Air Force (June 12).

Princess Mary's Royal Air Force Nursing Service

The following Staff Nurses are promoted to the rank of Sister on the dates stated:—Miss G. L. Pilgrim (September 12); Miss A. B. Young (September 30); Miss L. N. Jamieson (October 1); Miss M. A. Hawkins (October 3).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The following are granted commissions in class CC as Squadron Leaders (Acting Wing Commanders) on the dates stated:—Lt. Col. J. M. Brickman (I.A., Ret.) (May 17); Lt. Col. K. D. F. McCaskill, O.B.E. (R.I.A.S.C., Ret.) (July 31).

Flying Officer A. E. Mayers relinquishes his commission in class BB on appointment to a commission in the Royal Air Force Volun-teer Reserve (September 19).

The following relinquish their commissions in class CC on appoint-ment to commissions in the Royal Air Force Volunteer Reserve (September 1).—*Squadron Leaders.*—H. F. Anns, J. G. Argles, O. C. Cassells, D.F.C., F. V. Gauntlett, G. E. Gordon-Duff, J. H. Harris, J. C. Mitchell, E. J. Moule, G. I. C. Peacocke, H. E. F. Saunders, T. J. Southern, E. M. Thompson, R. T. H. Watson, G. A. Wells, M.C., F. B. Young. *Flight Lieutenant* (*Acting Squad-ron Leader*).—W. G. Nicholls. *Flight Lieutenants* (*Hon. Squadron Leaders*).—F. Thomasson, D.F.C., M.M., C. M. Crowe, M.C., D.F.C. *Flight Lieutenants.*—R. E. Barrett, R. Jones, R. S. Hellier, D.F.C., H. G. Spearpoint, H. P. S. Glogstoun, M.B.E., L. H. Brooke, J. W. Griffith, A. J. P. Groom, J. E. Preston, G. M. F. O'Brien, D.S.C., R. F. de R. Read, S. H. Reynolds, J. P. Cafferkey, G. F. M. Warner, H. A. C. Atkinson, W. L. Whitlock, J. F. Clark, A. F. Ingram, H. S. Martin, A. H. Beach, D. G. Singleton, J. W. Caddy, J. M. Evans, V. A. Watkins, the Rt. Hon. Lord Dudley, J. L. Bell, H. P. Johnston, A. G. Tremain, H. D. H. Wardrop, E. O. Whitamore, F. L. Woledge, R. Hems, J. M. Pye-Smith, C. S. Ramsay, W. V. Sherwell, H. D. Wardle, M. Hunter, A. W. H. Nelson, H. A. Blain, J. F. V. Sugars, H. H. Harries, F. Marshall, T.D., V. Mercer-Smith, D. K. Cameron, W. H. Costello, R. K. Coupland, C. L. Hudson, H. F. Game, A.F.C., C. N. McLoughlin,

THE FIRST WAR D.F.C.: Flight Lieut. (now Acting Squadron Leader) K. C. Doran, who led the air raid on Wilhelmshaven and dropped a heavy bomb on one of the "pocket battleships." He has been awarded the Distinguished Flying Cross, and the purple and white ribbon can be seen on his tunic.

Service Aviation

H. J. Crampton, J. M. Wells, N. McLeod, V. W. H. Venour, M.B.E., A. W. Wood, J. N. Mearns, G. G. Simpson, D.S.C., M. E. S. Thompson, M.C., C. W. Black, E. H. Rundle, L. S. Cundell, W. H. Stiles, F. C. Hornsby-Smith, F. E. Sheppard, N. L. Angelo, R. D. Boyd, N. E. Maitland, A. V. Taylor, W. Mitton, F. M. St. H. Evans, D. R. Macdonald, J. P. D. MacLagan, G. H. Clayton, W. A. Barnes, J. C. Williamson, C. A. Wright, J. S. Wilson, W. T. Doherty, H. P. N. Gubbins, E. J. Bell, L. J. L. Pullar, M.C., F. W. Wrench, J. E. W. Sugden, E. H. Hereford, R. M. Waddington, C. G. L. Bowley, H. E. Chapman, J. F. H. Hargrave, J. Evason, C. J. Farrell, W. E. H. Muir, M.C. *Flying Officers* (*Acting Squadron Leaders*).—R. A. Ford, D. G. H. Ross, N. H. F. Unwin. *Flying Officers* (*Acting Flight Lieutenants*).—J. E. Beynon, H. G. Henley, N. W. Wale, R. A. Davies, A. S. Budge. *Flying Officers* (*Hon. Flight Lieutenants*).—E. E. Page, G. Burdick, H. W. Guy, F. J. Haney, M.C., D.F.C., A. H. Jones. *Flying Officers.*—J. Collier, D.F.C., H. E. Wood, A. H. S. Browne, H. S. R. Critchley-Salmonson, F. L. Wheeldon, D.S.O., Ll. S. Lloyd, N. W. Jones, P. J. T. Baddiley, M.B.E., H. Sanders, P. G. S. Gardiner, L. B. Felton, L. E. G. Hawkins, E. D. S. Groome, C. E. Buck, R. E. Butler, J. K. Watson, A. H. E. King, B. O. Angell, M.B.E., F. G. Steel, R. C. Egerton-Green, F. V. Sheard.

Royal Air Force Volunteer Reserve

General Duties Branch

The following are granted commissions as Pilot Officers (October 10):—H. W. S. Adams, A. O. L. Stevens.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—R. H. J. Mountford (September 23); S. F. Preston, G. A. Worth (October 1); C. L. Elliott, D. R. J. Paterson (October 2); T. H. Worth (October 5); M. D. Scott (October 7); W. T. Aitken (October 9).

The following Pilot Officers relinquish their commissions on appointment to permanent commissions in the Royal Air Force (October 7):—P. H. Baldwin, K. D. Bruce, G. L. Cheshire, B. A. Rogers, A. C. L. Akroyd-Stuart, D. F. Braham, O. O'N. Briginshaw, R. W. Whittome.

Administrative and Special Duties Branch

The following are granted commissions in the ranks stated with effect from September 1, and with seny. of the dates stated:—*Squadron Leaders.*—Flying Officer R. A. Ford (R.A.F.O.) (August 23, 1938); Maj. H. F. Anns (December 1, 1938); Flying Officer G. D. H. Ross (R.A.F.O.) (April 27); Flying Officer N. H. F. Unwin (R.A.F.O.) (May 1); G. I. C. Peacocke (May 12); J. G. Argles (May 13); Flying Officer E. J. Moule, E. M. Thompson, Capt. J. H. Harris (I.A., Ret.) (May 22); Capt. G. E. Gordon-Duff (June 5); Flying Officer F. V. Gauntlett (June 6); Flying Officer T. J. Southern (June 9); Flight Lt. W. G. Nicholls (R.A.F.O.) (June 20); Capt. J. C. Mitchell (June 24); Lt. O. C. Cassells, D.F.C. (June 26); Capt. R. T. H. Watson (July 1); Flying Officer H. E. F. Saunders (July 15); F. B. Young (July 24); Capt. G. A. Wells M.C. (Aug. 1).—*Flight Lts.*—Flying Officer F. Susans, M.B.E. (R.A.F., Ret.) (Jan. 1, 1930); Flight Lt. R. E. Barrett (R.A.F.O.) (Nov. 9, 1935); Flying Officer J. V. Collins (R.A.F., Ret.) (Nov. 19, 1935); Lt. C. J. Clark (Jan. 1, 1936); Flying Officer R. Jones (March 11, 1936); Capt. R. S. Hellier, D.F.C., Flying Officer H. G. Spearpoint (March 16, 1936); Capt. H. P. S. Clogstoun, M.B.E. (July 20, 1936); Flying Officer H. Buxton (R.A.F., Ret.), Lt. A. J. Fricker, Flying Officer F. A. Pumphrey, Flight Lt. L. H. Brooke (R.A.F.O.), Capt. J. W. Griffith, Flying Officer A. J. P. Groom, Flight Lt. J. E. Preston, Flying Officer N. W. Wale (R.A.F.O.) (Nov. 1, 1936); Squadron Ldr. F. Thomasson, D.F.C., M.M. (R.A.F.O.) (Dec. 7, 1936); Flight Lt. G. M. F. O'Brien, D.S.C. (R.A.F, Ret) (Jan 21, 1937); Flying Officer R. F. de R. Read (Jan. 25, 1937); Flight Lt. S. H. Reynolds (R.A.F., Ret.) (March 8, 1937); Flying Officer J. P. Cafferkey (R.A.F., Ret.) (May 20, 1937); Capt. G. F. M. Warner (R.A.R.O.) (July 27, 1937); Flying Officer H. A. C. Atkinson (Jan. 1, 1938); Lt. H. F. Game, A.F.C. (Feb. 4, 1938); Lt. R. S. Higgens (Feb. 10, 1938); W. L. Whitlock (March 18, 1938); Flight Lt. J. F. Clark (R.A.F., Ret.) (May 4, 1938); Flight Lt. A. F. Ingram (May 27, 1938); H. S. Martin (June 1, 1938); Lieut.-Comdr. W. P. Phillips (R.N.R.) (June 24, 1938); Flight Lt. F. Boston (R.A.F., Ret.) (July 4, 1938); Flight Lt. M. Keegan, O.B.E., M.M. (R.A.F., Ret.) (July 6, 1938); Flying Officer L. O. Atkins (July 18, 1938); Flight Lt. A. H. Beach (R.A.F., Ret.) (Aug. 4, 1938); Capt. J. Collier, D.F.C., Flying Officer D. G. Singleton (Sept. 5, 1938); Lt. D. P. Walter (Sept. 12, 1938); Sec. Lt. F. Masson (Sept. 16, 1938); Flying Officer J. W. Caddy (R.A.F., Ret.), F/O. R. A. Davies (R.A.F.O.) (September 19, 1938); Capt. E. Gribben, M.C. (November 1, 1938); J. M. Evans (December 31, 1938); V. A. Watkins (January 2); The Rt. Hon. Lord Dudley (January 6); Lt. J. L. Bell, F/O. H. G. Henley (R.A.F.O.), Maj. H. P. Johnston (T.A.R.O.), Lt. A. G. Tremain, H. D. H. Wardrop, E. O. Whitamore, Capt. F. L. Woledge (late I.A.) (January 16); Sec. Lt. H. P. Eustace, R. Hems (January 30); Capt. J. M. Pye-Smith (February 6); Sec. Lt. W. M. Worman (February 9); Sec. Lt. P. F. Davies (February 15); Lt. C. S. Ramsay (February 18); Maj. W. V. Sherwell (March 1); Maj. C. M. Crowe, M.C., D.F.C. (March 13); F/O. H. D. Wardle (March 15); Capt. M. Hunter (April 1); Sec. Lt. C. L. Hudson, A. W. H. Nelson, Lt. A. H. Pownall (April 3); Lt. H. A. Blain, F/O. J. F. V. Sugars (R.A.F., Ret.) (April 11); Maj. W. E. H. Muir, M.C. (April 13); Capt. H. H. Harries (April 24); F. Marshall, T.D. (April 25); F/O. H. W. Roberts (R.A.F.O.) (May 15); Lt. V. Mercer-Smith (May 16); F/O. J. E. Beynon (R.A.F.O.), D. K. Cameron (May 22); F/O R. K. Coupland (R.A.F.O.) (May 31); Capt. W. H. Costello (T.A.R.O.); N. McLeod, Maj. V. W. H. Venour, M.B.E., A. W. Wood (June 12); J. M. Wells (June 23); C. N. McLoughlin (June 24); Lt. H. J. Crampton (July 6); Lt. J. N. Mearns, Capt. G. G. Simpson, D.S.C., Capt. M. E. S. Thompson, M.C. (July 10); Lt. M. V. Barton, C. W. Black, Flt. Lt. E. H. Rundle (R.A.F., Ret.), R. T. Ward (July 17); Lt. L. S. Cundell (R.A.R.O.), Flt. Lt. W. H. Stiles (R.A.F.O.) (July 24); F. C. Hornsby-Smith, Capt. F. E. Sheppard (I.A. Ret.) (July 26); Capt. N. L. Angelo (I.A., Ret.) (July 27); R. D. Boyd (July 31); Capt. J. H. S. A. Skinner, Lt. P. J. T. Baddiley, M.B.E. (R.A.R.O.), C. H. Baker, Capt. A. V. Taylor, Maj. B. S. Stone (I.A., Ret.), F/O. H. Sanders (R.A.F.O.), Flt. Lt. G. Burdick (R.A.F.O.), Capt. D. S. Cairnes (R.A.R.O.), Lt. S. H. Wrinch, Capt. C. V. Mercer, J. M. Clarke, F/O. P. G. S. Gardiner (R.A.F.O.), Capt. H. W. Guy, Lt. B. C. W. Windle, D.F.C., Lt. H. V. Alexander (I.A., Ret.), Capt. L. E. Cording, M.C., M.M., F/O. J. Evason (R.A.F. Ret.), Capt. W. Mitton, Capt. F. M. St. H. Evans, F/O. J. V. Hay (R.A.F.O.), Lt. L. B. Felton, Lt. L. E. G. Hawkins, Lt. U. P. Jonckheere, Capt. D. R. Macdonald, Lt. J. P. D. MacLagan, Lt. G. H. Clayton, Lt. W. A. Barnes, Lt. H. E. Storey, R. H. H. Bundle, Lt. H. C. House, Capt. F. J. Haney, M.C., D.F.C., F/O. C. J. Rhind, F/O. N. E. Maitland, Capt. A. H. Jones, Sec. Lt. J. S. Wilson, Capt. R. W. Scoles, Sec. Lt. W. T. Doherty, Sec. Lt. W. O. G. Fenton, Capt. W. N. Tees, Lt. E. D. S. Groome, Lt. F. S. Symonson, M.C., F/O. G. F. P. Warren (R.A.F., Ret.), Capt. E. E. Page, Lt. F. G. Steel, Sec. Lt. C. F. Kennedy, Lt. F. W. Knox, Lt. G. E. Cooper, Lt. B. O. Angell, M.B.E., Lt. F. A. B. Barnard, F/O. C. E. Stuart, Lt. J. C. Williamson, Sec. Lt. C. A. Wright, Sec. Lt. A. H. E. King, Lt. J. K. Watson, Lt. R. E. Butler, Sec. Lt. F. Jones, Lt. W. J. Metcalfe, Sec. Lt. H. P. N. Gubbins, Sec. Lt. C. E. Buck, Capt. A. T. R. Bradshaw (I.A. Ret.), F/O. A. S. Budge (R.A.F.O.), R. C. Egerton-Green, Lt. S. M. Garrett, Maj. E. J. Bell (I.A., Ret.), Lt. E. C. C. Haggart, Lt. F. V. Sheard, Lt. T. A. Tindle, Lt. V. G. Austen, Capt. L. S. Lloyd, N. W. Jones, Lt. C. G. Vandyk, Lt. G. A. L. Henniker, Lt. E. W. Norris, Maj. L. J. L. Pullar, M.C., F/O. F. W. Wrench (R.A.F., Ret.), Lt. F. L. Wheeldon, D.S.O., Lt. J. E. W. Sugden, Lt. H. S. K. Critchley-Salmonson, Lt. E. H. Hereford, Capt. H. E. Parker, Lt. R. M. Williams, Lt. F. A. Baker, Capt. R. M. Waddington, Lt. H. E. Wood, Lt. A. H. S. Browne, Lt. C. G. L. Bowley, Lt. H. E. Chapman, Capt. J. F. H. Hargrave (I.A., Ret.), C. J. Farrell (September 1).

A. E. Eaton, D.S.O., is granted a commission for the duration of hostilities as Flight Lieutenant (October 6); D. H. Preist is granted a commission for the duration of hostilities as Pilot Officer (acting Flight Lieutenant) (September 5) (Substituted for notification in *Gazette* of September 19).

The following are granted commissions for the duration of hostilities as Pilot Officers on probation with the hon. ranks stated (October 10):—*Flight Lieutenant*—H. E. Darby. *Flying Officers.*—N. E. Bonner, D. T. Davies, R. J. C. Farrell, H. B. Griffiths, A. Johnson, J. C. Masters, W. G. Pyrce, L. Richards, E. B. Rodmell.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—F. K. Kennedy (September 26); M. G. Harris (September 27); N. R. Dobree (October 2); W. B. Calder, R. H. Esencourt, H. Morris (October 3); H. J. R. Cox, T. F. Johnson, F. R. Offord, H. V. Pexton, W. H. R. Reader (October 4); W. R. Hammond, P. A. Harding, J. E. Jewell, R. F. Selby (October 5); H. P. Blakely, R. G. Coates, R. M. Sanders (October 6); H. de Gaspé Domville, J. S. Hodges (October 7); F. L. Wills (October 8); J. Lomas, G. Salaman (October 9); G. N. Blundell, A. P. C. Bruce, M. H. Frame, J. G. Gore, M.M., T. A. S. Harpham, G. Higginbottom, B. A. Levey, P. D. Macdonald, M.P., G. H. M. Miles, A. Miller, R. W. Potts, A. M. W. Proctor, A. V. Randall, H. O. Richards, J. H. Rutherford, D. C. Shaw, F. J. F. Smythe, W. F. Willis, S. J. Wise (October 10).

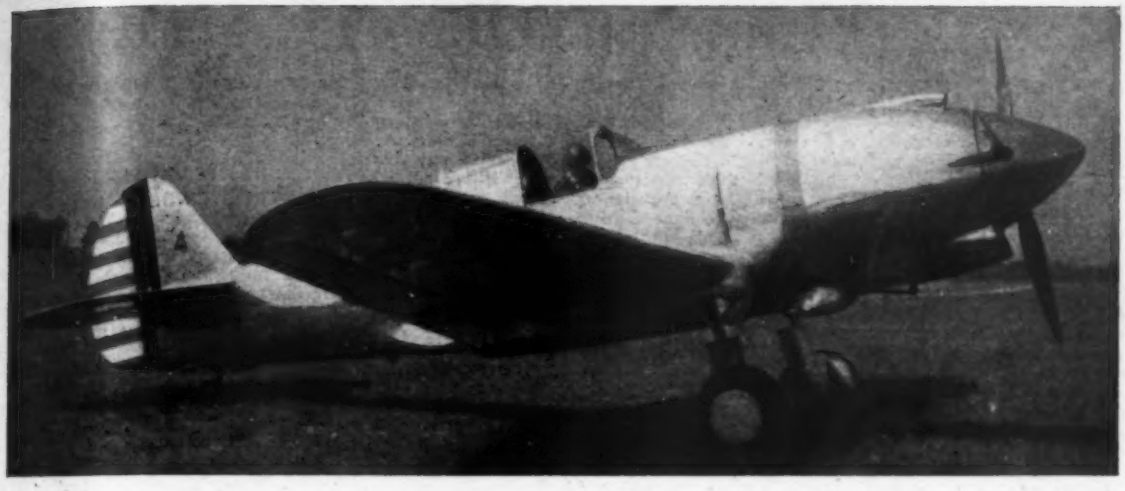
N. Wilkinson is granted an honorary commission as Air Commodore (October 10).

The following are granted honorary commissions as Wing Commanders while serving as Royal Air Force representative on University Joint Recruiting Boards, with effect from the dates stated:—C. M. Attlee, M.A., T. Evans, B.Sc., A.I.C., W. T. Farr, A. N. Gibson, D.Sc., LL.D., M.Inst.C.E, M.I.Mech.E., J. Goodden, G. H. Haydock, M.A., B.Litt., T. R. Henn, M.A., F. T. Hill, F.R.Ae.S., M.I.Ae.E., A. C. Menzies, M.A., D.Sc., F.I.P., G. G. Nicol, D.S.O., Col. Sir. G. F. Roberts, O.B.E., T.D., J.P., D.L., V. H. L. Searle, M.Sc., Maj. R. H. Thornton, M.C., R. Whiddington, M.A., D.Sc., F.R.S., Capt. R. Williams (September 4); Sir J. D. Pollock, O.B.E., LL.D., D.L., M.D., C.M., D.Sc., F.R.S. (September 25).

W. P. Wilson is granted an honorary commission as Squadron Leader (October 10).

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—F. J. H. Bacon (June 11); W. Burningham-White, J. C. Ferguson, J. H. Maguire, D. H. Oakley, A. W. Rouse, E. O. Rutherford (June 18); F. H. Dear, M.C., J. T. Duckworth, P. C. M. Dudeney, R. B. Martyn, M.C., J. W. Sparrow, M.M., H. F. G. Waters (June 25); A. B. Carter, C. E. Channing, A.F.C. (June 29); S. H. Bird, G. E. Norman (July 1); A. C. Curtis, S. Jolley, M.C., A. Niven, A. T. Smith (July 2); W. H. Bayley, H. Boydell, B. G. Groner, A. H. C. Randall, D. N. Reid (July 9); E. R. Ortner, E. Walker, D.F.C. (July 15); J. G. Collins, R. Cook, H. B. Dakin, M.B.E., S. M. B. Edwards, D.F.C., W. A. Simmons (July 16); J. W. Sim (Hon. Flight Lieutenant) (July 21); E. G. Oakley-Beuttler, O.B.E. (July 22); J. S. Dykes, C. H. Parsons (July 23); E. M. Ackery, A.F.C. (July 30); J. Scott-Taggart, M.C. (August 6); J. W. Patterson (August 11); G. D. Ashby, Sir A. R. W. Curtis, K.C.V.O., C.M.G., M.C., L. S. Thompson, H. A. M. Whyte (August 12); R. W. Mitchell (August 13); J. R. Pairman (August 15); T. E. J. Hewitt (Honorary Flight Lieutenant) (August 17); F. H. R. Law, J. A. Stanbrook (August 20); J. F. Houchin (August 21); A. McC. Wilson, O.B.E. (August 31); M. Watney (September 4).

It is regretted that it is necessary to hold over until next week the final section of this Gazette.



SOMETHING NEW IN COWLINGS: The Curtiss P-42 pursuit monoplane with an experimental installation of a two-row Pratt and Whitney with airscrew extension shaft. Cooling air enters through the scoop to the rear of and below the spinner and is exhausted through the adjustable gills.

FOREIGN SERVICE NEWS

High Explosive Bombs

INFORMATION on bombs is so scarce these days that the following two quotations from the American and Italian technical Press are of special interest.

It is stated in the American publication, *Army Ordnance*, that anti-personnel bombs must explode as soon as they touch the ground. Bombs for the destruction of buildings, on the other hand, must penetrate before exploding, *i.e.*, the explosive must be insensitive enough to stand the shock of impact, and only respond to a separate fire mechanism functioning with a definite delay. Both types of bomb fillings must not explode if accidentally struck by bullets or shell splinters whilst being carried by the aircraft.

Dynamite and other explosives containing nitroglycerine are much too sensitive for bomb filling. The usual explosive employed is T.N.T. (trinitrotoluene). In cases where destruction by "blast" is effective, trinitro benzene is recommended.

A good deal has been heard about liquid oxygen as a constituent of bomb fillings. Mixtures of liquid oxygen and cork dust or powdered aluminium form powerful and safe explosives. Unfortunately, the liquefied gas evaporates, and the explosive must be used very soon after preparation in order to be effective. As an alternative, liquid NO_2 can be used in closed containers. Mixed with CS_2 or petrol, it forms the explosive called anilite.

T.N.T. does not contain enough oxygen for complete combustion, and thus produces a black smoke. This difficulty is overcome by the addition of amonium nitrate, the mixed product being known as amatol. The amonium nitrate is itself explosive, and, since it contains an excess of oxygen, the addition of powdered aluminium is very effective.

It is probable that the German bombs used in Spain and described in the Press as containing an explosive made from air contained amonium nitrate, since the latter is a by-product of the fixation of atmospheric nitrogen.

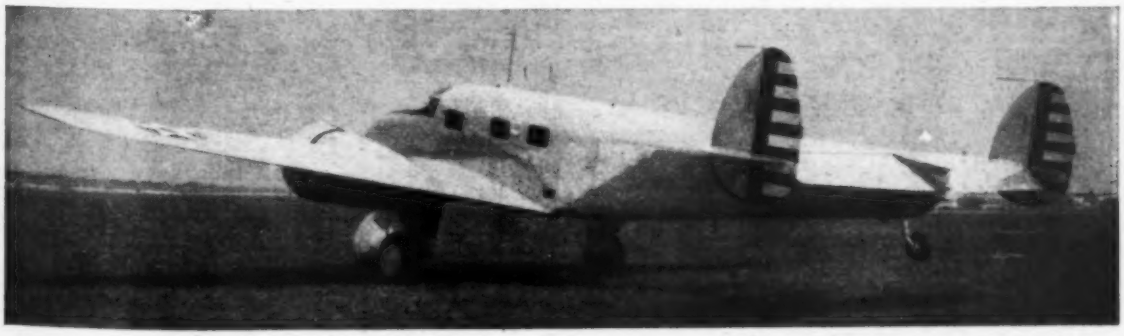
An article from the Italian states that in the 1914 war the principal explosives were picric acid (melinite) and T.N.T. The latter requires 400 kg. of coal for 1 kg. of explosive, and a bomb of 2,000 kg. is thus equivalent to a train-load of coal.

As a result, alternative methods of manufacturing explosives have been considered which take CO as a starting point. This is hydrogenated, producing in turn methyl alcohol and formaldehyde. The latter acts as a basis for four complex explosives: (1) pentrite (tetranitrate of pentaerythrene); (2) T_4 (trimethylene trinitroamine); (3) tetranitrate of isobutylglycerine; (4) peroxide of hexamethylene diamine. Only the first two of these are of interest for aerial bombs. Although the cost is more than double that of T.N.T., the expenditure may be justified, as these explosives are 50 per cent. more powerful, and the weight of the bomb is thus reduced. Although the finished product is very stable, the filling process is complicated by the fact that fusion and decomposition temperatures are relatively close. For this reason the new explosives are often mixed with other products to reduce the sensitivity. Thus we have the pemtrinite of Professor Stettvacher (Pemtrite + nitrateglycerine), the Bomite produced by the Bofors concern (T_4 + T.N.T.), and finally a product of the Italian chemist Tonegutti (pemtrite + amonium nitrate + dicyanodiamide).

A Tactical Experiment

A "LABORATORY" in which new tactical ideas and new equipment will be tried out is now being organised by the United States Army Air Corps. In effect, it will be a miniature air force containing all the major classifications of aircraft. Officially, it will be known as the 23rd Composite Group. The latest types of machine will be provided and the unit will be kept at full operational strength. It will be based at the home of the Air Technical School at Maxwell Field, Montgomery, Alabama.

In addition to the present headquarters squadron at Maxwell Field, the new unit will contain the 24th Attack-Bombardment Squadron with eighteen officers, the 54th Bombardment (medium) Squadron with thirty-one officers, and the 1st Pursuit Squadron with twenty-seven officers. The total strength will be eighty-one officers and 614 enlisted men. In command will be Maj. Frank O'D. Hunter, who is described as "the only third-degree member of the Caterpillar Club."



FOR BLIND-LANDING EXPERIMENTS: The Lockheed C40-B which will be used by the U.S. Army Air Corps for instrument-landing experiments. The machine weighs 9,200 lb. and carries a pilot and four test observers. It appears that the undercarriage is fixed; certainly this is true of the nose wheel, which is carefully faired. It will be noted that a conventional tail wheel is also fitted as a precautionary measure.

WARTIME FACTORY LIGHTING

OF ESPECIAL INTEREST at the present time is a twelve-page pamphlet issued by Philips Lamps, Ltd., describing their "Philora" electric discharge lamps for lighting industrial and commercial premises under war conditions. Economy in energy consumption is common to the whole "Philora" range, and efficiencies of from three to five times the luminosity of half-watt lighting are claimed for the same consumption.

The different purposes group themselves into four sections: (1) Illumination during periods when ordinary lighting is required; (2) illumination of premises which are "blacked out" and consequently require artificial lighting during day as well as by night; (3) for the illumination of premises and, at the same time, obtaining effective "blacking-out" without the loss of daylight and without the use of blinds, shutters or painted windows; (4) the so-called "black" lighting to show up fluorescent painted essential points during darkness.

Sections 1 and 2 are catered for by the use of Philora Sodium lamps (golden yellow), Mercury lamps (bluish-white) or Fluorescent Mercury lamps (near white). The latter are used where colour discrimination is necessary.

Golden-yellow sodium lamps, in conjunction with a special blue varnish, are used for section (3). This system is particularly ingenious. The yellow light is a single pure colour from the spectrum, and if a filter is used which passes none of this colour—in this instance the blue varnish—a complete "black-out" effect is obtained.

Briefly, if the roof lights and windows are varnished with this special blue, and the lights are shaded in such a way that the actual sources of light are cut off from the windows, the change-over from daylight to night working is automatic. This has the added advantage of the use of a fair percentage of daylight during the light hours. It also avoids that feeling of heaviness associated with the continual use of artificial light during the daytime.

The "black" light mentioned in section (4) is equally ingenious, use being made of the ultra-violet rays emitted from mercury lamps. The outside glass is such that only the ultra-violet can pass. This is almost invisible to the human eye, and if essential points, such as switches, door handles, etc., in the vicinity of the lamp are painted with fluorescent paint they can easily be discerned in the apparent darkness.

It is impossible for us to go into very great detail, but Philips Lamps, Ltd., have a staff of highly trained lighting engineers whose job it is to give advice and service where required. Lighting schemes are prepared without any obligation on the part of the enquirer.

The full address is Philips Lamps, Ltd., Philora Dept., Century House, Shaftesbury Avenue, London, W.C.2. There are branches at Liverpool, Nottingham, Birmingham, Glasgow, Manchester, Newcastle, Leeds, Bristol and Dublin.

London Aluminium

MESSRS. WILLIAMS (BIRMINGHAM), Ltd., announce that they have acquired the London Aluminium Co., who are well known throughout the aircraft industry as sheet metal workers and makers of light metal components.

A large factory embodies all the necessary modern plant for producing stampings, spinnings and general construction. A considerable volume of aircraft work was executed by this firm in the 1914-18 war, so that experience of aeronautical practices is not lacking.

Phosphor Bronze Board

CONTINUOUS expansion and the ever-increasing demand for the company's products are the reasons for the reconstitution of the directorate of the Phosphor Bronze Co., Ltd., of London and Birmingham.

At a recent board meeting the following appointments were made:—Chairman, Mr. E. J. Hardy; Joint Managing Director, Mr. J. L. Hardy; Joint Managing Director and Sales Manager, Mr. W. Smithson; Director, Production Manager and Sole Purchasing Agent, Mr. G. T. Hyslop; Directors, Messrs. E. H. Powis, W. E. Sparrow and F. R. Wix. In addition Mr. S. B. Michael was appointed London and Export Sales Manager, and Mr. C. V. McNeil, Birmingham Works Sales Manager.

Lightweight Electric Motors

CROYDON ENGINEERING CO., LTD., in a broadsheet issued by them, draw attention to their long experience in the design and manufacture of fractional horse power motors for specialised purposes.

"Where the use of electric motors is concerned," the broadsheet states, "the Croydon Engineering Co., Ltd., can claim a certain degree of specialised knowledge, both as regards the design and manufacture of high-efficiency lightweight motors and their employment in modern aircraft. . . . Our designers have approached the problem on its own merits, taking carefully into account the nature of the duty to be performed and translating this into terms of design. It will be apparent that this method of suiting the motor to the work implies considerable advantages over the method of choosing, for any given purpose, the stock machine whose characteristics correspond most closely to requirements."

Croydon Engineering Co. are always ready to give advice, engineers being kept specially for this purpose at the factory at Commerce Way, Purley Way, Croydon. Midland enquirers are referred to Service House, 1, Fleet Street, Birmingham, 3.

Fire-resisting Cable

CALLENDERS, the well-known cable manufacturers, have sent us particulars of their new C.M.A. fire-resisting cables. It is claimed, after exhaustive tests, that while the qualities of flexibility and ease of installation associated with standard rubber-covered cable are still retained, the new cable will extinguish itself immediately on the removal of the source of heat, regardless of type, intensity of flame, or period of application. This important departure has an obvious use where aircraft is concerned, in addition to normal use in offices and factories.

Full particulars are available from Callender's Cable and Construction Co., Ltd., whose head office is at Hamilton House, Victoria Embankment, London, E.C.4.

Impervious

IMPERVIA, LTD., of 3, Grosvenor Gardens, London, S.W.1, send us particulars of the Impervex specialised rubber products. The claim made would appear to be extravagant were it not for the copies of communications from the Air Ministry and the Royal Aircraft Establishment substantiating such claims.

Different qualities are manufactured for various purposes, but all grades are impervious to acids, alkalis, ammonia, alcohol, chlorine, petroleum, Discol gas, fuel oil, di-ethyl-glycol and hot lubricating oil in varying degrees. B-quality, for instance, resists hot oil up to 290 deg. F., and C-quality resists cooling mixtures up to 120 deg. C., while B.E. quality, as thin as 1.35 mm., has a dielectric resistance of 30,000 volts (Faraday House tests), and is also impervious to hot lubricating oil of 95 deg. C. There is an application for almost every purpose where the properties of rubber are required under very severe conditions.

In Brief

THE directors of Vickers, Ltd., give notice that an interim dividend of 4 per cent. (actual) less income tax on the ordinary stock of the company in respect of the year 1939 will be paid on October 26, 1939.

The directors of J. Samuel White and Co., Ltd., shipbuilders, of Cowes, I. of W., announce a dividend of 3 per cent. less income tax on the 6 per cent. cumulative preference shares in respect of the half-year ending October 5.

The Buenos Aires agent for David Moseley and Sons, Ltd., requested recently, when he sent over very substantial orders, that ten per cent. of his commission on these and future orders should be given to the British Red Cross or to the Manchester Infirmary "as a modest contribution to help those suffering through defending freedom against brutality."

AERONAUTICAL PATENTS

28770. HEINKEL, E., and GUNTER, S.: Aerofoils for aircraft (511,003).

31616. SPERRY GYROSCOPE CO., INC.: Automatic pilots for aircraft (510,767).

35564. BRANDENBURGISCHE MOTOREN-WERKE GES.: Conduits for guiding cooling air from a blower to an air-cooled radial engine (510,937).

36169. KSOLL, J.: Aeroplane supporting wing (510,774).

36191. DAIMLER-BENZ AKT.-GES.: Vehicle steering-mechanism for multi-wheel steering (511,120).

2246. RHEINMETALL-BORSIG AKT.-GES. and WINZER, K.: Percussion fuzes (511,019).

14339. TOWLER, C.: Valve rocker push-rods for internal-combustion engines (510,863).

14340. TOWLER, C.: Tappets for internal-combustion engines (510,864).

(*Published August 30, 1939.*)

6756. LUCAS, LTD., J., and ALLEN, A. MASSEY: Spark ignition distributors for internal-combustion engines (511,491).

35211. SCHWARZ, G., and SCHWARZ, O.: Air-propeller (511,422).

1107 COURTNEY, F. T.: Aeroplane (511,188).

4105 SMITH AND SONS (MOTOR ACCESSORIES), LTD., S., and MOSS, E. B.: Gyroscopic turn-indicators for aircraft (511,196).

4629. BOSCH GES., R.: Starting devices for internal-combustion engines (511,280).

October 26, 1939

Supplement to FLIGHT

3404

THE AIRCRAFT ENGINEER

No. 165. (Volume XVIII No. 9) 14th Year

October 26, 1939

KILLING the STALL

Approach from a New Angle Aids Landing Technique

By W. E. GRAY, D.F.C.

EVERY aeroplane pilot since the very earliest days has had in the back of his mind the uncomfortable feeling that if he lost speed and allowed his aeroplane to stall he would incur grave risks through loss of control, especially if near the ground. The only design change that has alleviated this position at all, and which has had any wide practical application, has been the wing tip slot. It has certainly saved many lives in the past decade, but even it does not give safety in the extreme stalled states of spinning; we must therefore search again if we are to master the stall completely.

It is proposed to give here a brief account of a fresh attack on this problem, which seems to have yielded an answer of some practical value, and a description of the model and full-scale tests that have been carried out in the study of its possibilities. These tests were in four stages: first, small wind-tunnel tests; secondly, small flying dynamic model tests, both in the open air and in a small vertical free-spinning tunnel; thirdly, autorotation and control tests on a large model wing (6ft. span) on a car at high speed; and fourthly, flying tests on a single-seater tapered low-wing light monoplane.

Briefly, it may be said that it has been found possible to obtain a completely fool-proof aeroplane with little change in design, and that the needed modifications can be made to existing aeroplanes with little difficulty. The only serious doubt that arises is whether the treatment can be applied with equal results to flapped aeroplanes; this is, of course, an important point, and the full-scale evidence is rather discouraging, for while with a narrow flap on a 2:1 tapered wing the result was satisfactory, yet a later test with a large flap on a 4:3 taper gave very disappointing results. However, the machine with 2:1 taper was made stable and fully manœuvrable with ordinary ailerons far beyond the stall, so that it is felt that publication of the method will serve a useful purpose and add something to safety—even if the ultimate application of the idea is only to the smaller types of aeroplane used for private flying, and it should prove to be ineffective on heavily flapped machines.

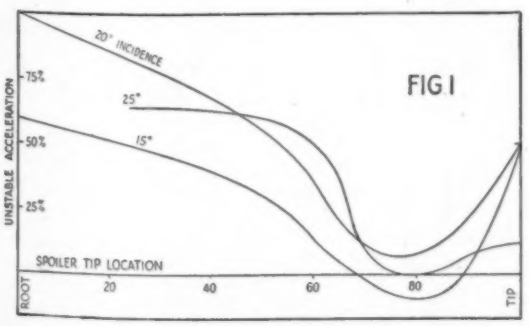


Fig. 1 Model test results.

Simplicity

To avoid lateral instability at the stall it is necessary to avoid any sudden breakdown of the airflow over the outboard parts of the wing, and the tip-slot tackles this by preserving a smooth flow at incidences much in excess of the stalling angle of a plain wing. The present method is just the reverse of this, and consists in the spoiling of the airflow at a chosen point near each wing-tip; this likewise avoids a sudden large breakdown of flow.

At first sight, of course, this method might seem absurd, as it involves a very serious loss of lift; but if applied to a tapered wing, of which the maximum lift cannot be obtained except in the actual landing owing to the pilot being nervous of its stability at the lower speeds, then it becomes possible to fly with safety at a lower speed than before, despite any slight loss of maximum lift. Actually the full-scale test with 2:1 taper showed no readable change in A.S.I. minimum speed, while giving a reduction of about 10 per cent. in the safe minimum speed in calm air and about 15 per cent. in bumpy air.

The stabilising effect is accompanied by an almost surprising steepening of the glide, and this makes the approach very easy, provided a little speed is kept in hand for flattening out; the glide is steepened by as much as 10 deg., and the landing is very short, owing to the high drag. The most striking feature, however, is the way in which the aeroplane can be thrown about, even when fully stalled, by the use of ordinary ailerons alone, and the complete absence of any tendency to fall into a spin in any circumstances.

The aeroplane is merely provided with two small spoilers near the leading edge, placed at any position about 70 or 80 per cent. of the semi-span out along the wing. By leaving free a portion of the wing outboard of the spoiler, the airflow there is preserved to quite a high incidence, and the damping in roll is improved. The spoiler size used on a 32ft. span low-wing monoplane was only 2ft. × 4in.

Model Tests

The autorotation tests on the 6ft. span wing (Clark Y section, taper 2.7 to 1) showed that, until the spoilers were placed more than half-way out along the wing, there was no drastic change in the instability at the stall. Fig. 1 shows the approximate intensity of the instability when various amounts of wing tip (per cent. semi-span) are free of the spoilers. The spoiler size was 6in. × 1in., at 1in. from the leading edge, and it will be seen that there is a

Fig. 2. The model test rig on the author's car.

distinct optimum region. These curves should not be taken as strict scientific data, since the tests were only meant as a rough guide and a check on the small model tests, and they were not recorded with any accuracy; they should only be taken as a qualitative picture. They showed that the optimum spoiler location was wide and did not change with incidence. (This latitude in spoiler positions was also true of full scale.) The car test rig is shown in Fig. 2.

Rates of roll with various amounts of aileron and at varying incidences were also checked on the car model, and it was found that the presence of the spoilers only reduced very slightly the rate of roll, except at the incidences near the stall. At those incidences the ailerons alone caused autorotation to come into play as well, with high resulting rates of roll, and these rates were greatly reduced by the addition of the spoilers; the result was a gradual rise in the rate of roll as the stall was approached and passed, instead of a sudden jump in the rate just before the stall. This characteristic will naturally make for easier control at the stall.

Most of the car model tests were repeated with a split flap of about half-span on the wing, and no appreciable changes in behaviour were found. It was thus felt that enough had been done to justify full-scale tests, and to assure that they would be reasonably safe; they were therefore proceeded with.

Flying Tests

The machine chosen for the flying tests was a single-seater light monoplane with 2:1 taper ratio, and the spoilers were so arranged that their spanwise position could be altered easily; amounts of wing-tip beyond the spoiler varied from 5 to 40 per cent of the semi-span. One test was made at 50 per cent., but had to be abandoned because of violent tail buffeting, which was most unpleasant without a parachute. About 20-30 per cent. gave the best results, and at 40 per cent. there was a considerable drop in effectiveness; this bears out the curves in Fig. 1. As regards the gliding angle, the 25 per cent. location gave a glide at approximately 15 deg. instead of the normal 5 deg., whereas with the spoilers almost at the tips the glide was about 11 deg.

This trebling of the gliding angle called for a disconcerting change in one's ideas about the approach, but after a few landings the change was very welcome. It must be borne in mind, of course, that this device is only of service in the approach and landing, as its drag is too great for any other use, but in any case these operations are usually the most critical a pilot has to perform.

The airflow over a wing at a speed of approximately 10 per cent. above stalling speed is shown in Fig. 3. It will be seen that the flow over the main part of the wing is unspoilt by the spoiler near the tip. Other photographic evidence shows that with the spoiler more inboard the tip flow is preserved when all the rest of the wing is stalled.

Aileron Control

One of the set tests used was to fly straight and level near the stall and, with rudder held central, to rock the machine violently from side to side (bank of 20 deg. or more) with the stick and watch the wing alternately stall completely and then unstall, except for the part just behind the spoiler. Without spoilers this, of course, could not be done and an incipient spin resulted.

Unfortunately, the effect on the full spin could not be checked as the machine was not "aerobatic," but even some encouragement with the controls to do an incipient spin did not produce one when the spoilers were in operation, although without them the machine did incipient spins from the straight stall after dropping a wing. It is believed that with spoilers up it will be hard to get or keep a machine in a spin; free spinning model tests support this view.

The principal flying test was to stall the machine completely, both gradually and suddenly, while doing a tight spiral, and also to put it into such a spiral and take it out again while completely stalled. The expression "tight spiral" meant a bank of 45-60 deg., so it will be seen that there was nothing half-hearted about this test, and the fact that the aeroplane could be thrown into and out of these spirals at any stage in the development of the stall shows the complete change in stability that the spoilers bring about.

Fig. 3. Wool tufts used to show air flow at a speed of about ten per cent above stalling speed. The flow over the main part of the wing is unaffected by the spoiler near the tip.

Not only were these spirals carried out repeatedly, but they were filmed with a small hand cinema camera with comparative ease while one's flying view was that through the view-finder as one watched the wool tufts on the wing as it stalled. Considerable lengths of film were taken thus, showing the steadiness of the spiral by means of the view they gave of the ground and showing the simultaneous airflow conditions over the wing; nor was the job unpleasant.

In order to get a convincing film shot, one or two were taken from the ground of the approach and landing, and the machine was rocked violently with the ailerons into banks of about 20 deg. either side till the lower tip was some 20 feet from the ground. The aeroplane was then quickly levelled, and a three-point landing was made within four seconds of levelling; this showed that the approach was near the stall, and, of course, the high drag killed any tendency to float.

A temporary set of flaps was fitted to the machine later, but for the sake of structural strength they could only be 10 per cent. chord and at 30 deg., except over the wing root where the angle was 45 deg.; they were almost half-span. With these flaps the former spoilers 24 by 4 inches were just barely adequate, and the stalled spirals were at times somewhat unsteady. Without the spoilers the machine was more unstable laterally at the stall than before. The aeroplane in this state could, however, only be regarded as semi-flapped according to modern practice, and as already mentioned a later test on an aeroplane of lower taper ratio and with big split flaps yielded disappointing results.

The application to flapped aeroplanes is thus left open to doubt, at best, but the utility of the scheme in obtaining an aeroplane that is foolproof and stall-proof and spin-proof for the private pilot to make easy approaches and landings has at least been established. One only hopes that it may help to save a few lives.

[The author of this article, Mr. W. E. Gray, will be familiar to most *Flight* readers through the articles which he has contributed from time to time. We fear that, like the members of the A.A.F. he has "lost his amateur status," for we learn that he has joined the R.A.E. at Farnborough. It is to be hoped that he will find opportunity to continue his interesting private researches.—Ed.]

FLUTTER SPEED

A Routine Method for Calculating a Conventional Cantilever Wing

By J. C. K. SHIPP, B.Sc.

IN the annual report of the Aeronautical Research Committee for the year 1934-35, the following words appear: "We have recommended that in future routine calculations or experiments should be made for each new design to cover the possibilities of failure due to interaction of elastic and aerodynamic forces."

Only recently has it become possible to put the above recommendation into general practice, and for certain types of wing there are still difficulties to be overcome. It is proposed in this article to explain simply a routine method for determining the flutter speed of a conventional cantilever wing.

We shall assume that the wing is semi-rigid, i.e. the modes of deformation in flexure and torsion are independent of the aerodynamic forces. We may then represent the elastic deformation of the wing in terms of the flexure ϕ and twist θ at some typical "reference section." The "reference section" here adopted is at 0.7 of the wing overhang.

It is usual to do two series of tests on the wing. These are wing stiffness tests on the lines of R. & M. 1742 (Ref. 1) and wing "resonance" tests (Ref. 2). The former will enable us to determine the flexural axis position as well as the stiffness rates in flexure and torsion. The latter will enable us to determine the fundamental flexural and torsional frequencies (neglecting the usually small coupling effect) and also the modes of deformation in flexure and torsion. Fig. 1 shows a typical wing, with the flexural axis h chords behind the leading edge. Fig. 2 shows typical modes of deformation in flexure and torsion. The displacements at the reference section are taken as unity.

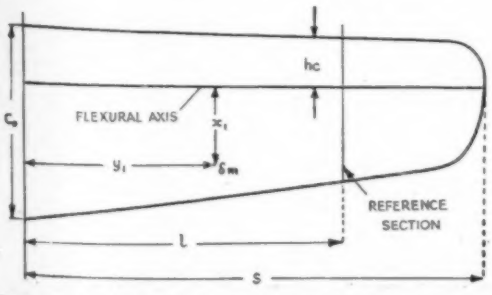


Fig. 1. Plan of a typical wing with the flexural axis h chord lengths behind the leading edge.

Of course, in the design stage it will not be possible to do the stiffness and resonance tests but, as we shall see, it is still possible to make good estimates of the flutter speed if the stiffnesses can be calculated.

As a basis for the routine calculation the simplified theory of wing flutter developed in R. & M. 1839 (Ref. 3) will be used. Equations (11) and (19) of that report give the following relations between the flutter speed V_e and the flutter frequency f.

$$f = \frac{1}{2\pi}\sqrt{\frac{K_3 + \frac{J_3}{B_1}C_1}{G_3 + \frac{J_3}{B_1}A_1}} \quad .. \quad .. \quad .. \quad .. \quad (1)$$

$$V_e = p\sqrt{\frac{P}{K_1' - \frac{B_1' J_3}{P}\left\{1 + \frac{J_3' A_1^2}{B_1' P^2}\left(1 - \frac{1}{p^2}\frac{C_1}{A_1}\right)^2\right\}}} \quad (2)$$

where

$p = 2\pi f$

and A_1 is the wing flexural moment of inertia

$B_1 = B_1'V$ is the wing flexural damping

C_1 is the wing flexural stiffness

G_3 is the wing torsional moment of inertia

$J_3 = J_3'V$ is the wing torsional damping

K_3 is the wing torsional stiffness

P is the wing product of inertia

$K_1 = K_1'V^2$ is the aerodynamic flexural moment due to wing twist

There are thus eight wing characteristics or "derivatives" to determine before the flutter speed and frequency can be found. We shall consider the inertia, stiffness and damping derivatives in turn.

The Inertia Derivatives

The three inertia derivatives are A_1, G_3 and P. The first two are immediately obtainable if stiffness and resonance tests have been done. If n_F and n_T are the fundamental flexural and torsional frequencies as obtained from

resonance tests, and $l\phi$ and m_θ, the flexural and torsional stiffnesses expressed as in R. & M. 1742 and measured at 0.7 of the wing overhang, then

$$n_F = \frac{1}{2\pi}\sqrt{\frac{l\phi}{A_1}} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (3)$$

$$n_T = \frac{1}{2\pi}\sqrt{\frac{m_\theta}{G_3}} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (4)$$

from which we have

$$A_1 = l\phi/4\pi^2 n_F^2 \quad .. \quad .. \quad .. \quad .. \quad .. \quad (5)$$

and

$$G_3 = m_\theta/4\pi^2 n_T^2 \quad .. \quad .. \quad .. \quad .. \quad .. \quad (6)$$

As mentioned above, it is possible to determine A_1 and G_3 even if the resonance frequencies and the stiffnesses are not known. It is necessary, however, to know the modes of deformation in flexure and torsion and if no other information is available the curves of Fig. 2 may be used. These are similar to those given in R. & M. 1782 (Ref. 4) and are typical of modern cantilever wings.

Referring to Fig. 1 let δm be an element of wing mass with co-ordinates x_1 and y_1 referred to the flexural axis and wing root x_1 being positive when measured downstream. We may then write for A_1 and G_3, referred to the reference

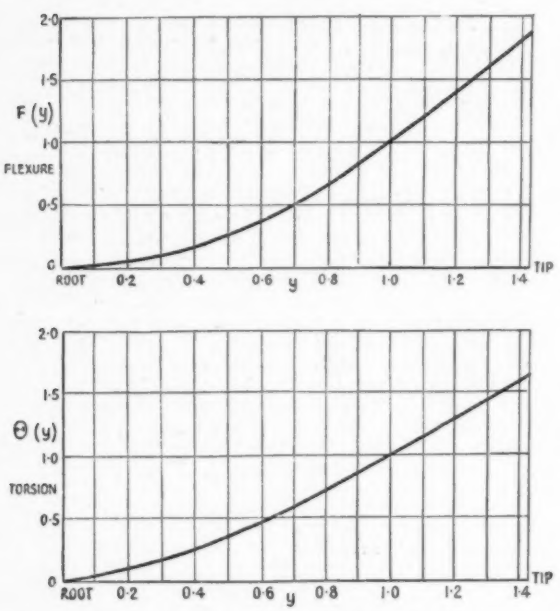


Fig. 2. Curves showing typical modes of deformation in flexure and torsion. The reference section is located at 0.7 of the overhang.

section at 0.7 of the overhang.

$$A_1 = \Sigma\delta m l^2 F(y)^2 \quad .. \quad .. \quad .. \quad .. \quad .. \quad (7)$$

and

$$G_3 = \Sigma\delta m x_1^2 \Theta(y)^2 \quad .. \quad .. \quad .. \quad .. \quad .. \quad (8)$$

Similarly we may write for P_1 the product of inertia

$$P = \Sigma\delta m l F(y)\Theta(y) \quad .. \quad .. \quad .. \quad .. \quad (9)$$

Writing $x_1 = xc$ (7), (8) and (9) become

$$A_1 = l^2\Sigma\delta m F(y)^2 \quad .. \quad .. \quad .. \quad .. \quad .. \quad (10)$$

$$G_3 = c_o^2\,\Sigma\delta m x^2\left(\frac{c}{c_o}\right)^2\Theta(y)^2 \quad .. \quad .. \quad .. \quad (11)$$

$$P = lc_o\,\Sigma\delta m x\left(\frac{c}{c_o}\right)F(y)\,\Theta(y) \quad .. \quad .. \quad .. \quad (12)$$

It is now necessary to know the spanwise and chordwise distributions of wing mass. The spanwise distribution is usually approximately proportional to some function of the chord and the chordwise distribution invariable along the span.

An example will make the analysis clearer. Consider a wing with the flexural axis at 0.3c behind the leading edge. Suppose that the spanwise distribution varies as the square of the chord and that the invariable chordwise distribution is linearly graded from leading edge to trailing edge, the leading edge loading being three times that of the trailing edge. If the wing has a 2 : 1 root to tip chord taper, then at any section of chord c the mass per unit length is given by $\frac{12}{7}\left(\frac{c}{c_o}\right)^2\frac{M}{s}$ where M is the total wing mass. Since $\frac{l}{s} = 0.7$ we have for A_1

$$A_1 = 1.2\,Ml^2\int_{root}^{tip}\left(\frac{c}{c_o}\right)^2 F(y)^2\,dy \quad .. \quad .. \quad .. \quad (13)$$

For the chordwise distribution the radius of gyration of a section about the flexural axis is equal to 0.296c and the centre of gravity of the section is at 0.4c from the leading edge.

These conditions give for G_3 and P

$$G_3 = 1.2 \times (0.296)^2 Mc_o^2\int_{root}^{tip}\left(\frac{c}{c_o}\right)^4\Theta(y)^2\,dy \quad .. \quad (14)$$

$$P = 1.2 \times 0.1\,Mlc_o\int_{root}^{tip}\left(\frac{c}{c_o}\right)^3 F(y)\,\Theta(y)\,dy \quad .. \quad (15)$$

The integrations are easily carried out graphically.

The Stiffness Derivatives

There are three stiffness derivatives to determine: the flexural and torsional stiffness derivatives C_1 and K_2 and K_1, the aerodynamical flexural moment due to wing twist.

The flexural stiffness term C_1 is straightforward. If W is a load applied on the flexural axis at the reference section and δ is the deflection at this reference section then

$$C_1 = l\phi = \frac{Wl^2}{\delta} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (16)$$

where l is the distance from the wing root to the reference section. The value of C_1 is easily determined by stiffness tests on the lines of those described in R. & M. 1742.[1]

The torsional stiffness derivative is not so straightforward because it has to include an aerodynamic component proportional to V^2. This aerodynamic term is usually small, but for a normal wing it increases with speed to make K_2 zero at the divergence speed. The elastic stiffness part of K_2 is found by measuring the twist θ about the flexural axis at the reference section due to a torque M at that section, and is expressed as

$$m_\theta = M/\theta \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (17)$$

The aerodynamic part of K_2 depends upon the position of the flexural axis and upon the torsional mode of deformation of the wing (see Fig. 2). From equation (70) of R. & M. 1518 (Ref. 5) we derive the following formula for the aerodynamic component of K_2 at any speed V.

$$K_{2(aero.)} = \rho V^2 lc_o^2(0.4 - 1.6h)\int_{root}^{tip}\left(\frac{c}{c_o}\right)^2\Theta(y)^2\,dy \quad (18)$$

In this equation ρ is the air density and the other symbols are self-explanatory after reference to Figs. 1 and 2. The numbers in brackets are determined from model tests. It will be observed that when the flexural axis is at the quarter chord so that $h = 0.25$, the aerodynamic part of K_2 is zero. This means that the wing will not diverge. In general h is greater than 0.25 and the aerodynamic part of K_2 is negative. We have for K_2 now

$$K_2 = m_\theta + \rho V^2 lc_o^2(0.4 - 1.6h)\int_{root}^{tip}\left(\frac{c}{c_o}\right)^2\Theta(y)^2\,dy \quad (19)$$

There is now the aerodynamic term K_1 which is a coupling term between flexure and torsion representing the bending effects of the aerodynamic loads due to twist. From equation (67) of R. & M. 1518 we obtain

$$K_1 = 1.6\rho V^2 l^2 c_o\int_{root}^{tip}\left(\frac{c}{c_o}\right)F(y)\,\Theta(y)\,dy \quad .. \quad .. \quad (20)$$

(Concluded on p. 335.)